AIR ENGINEERING

SEPTEMBER, 1960

AIR POLLUTION CONTROL • AIR MOVING • AIR CONDITIONING

THE UNIVERSITY OF MICHIGAN
SEP 20 1960
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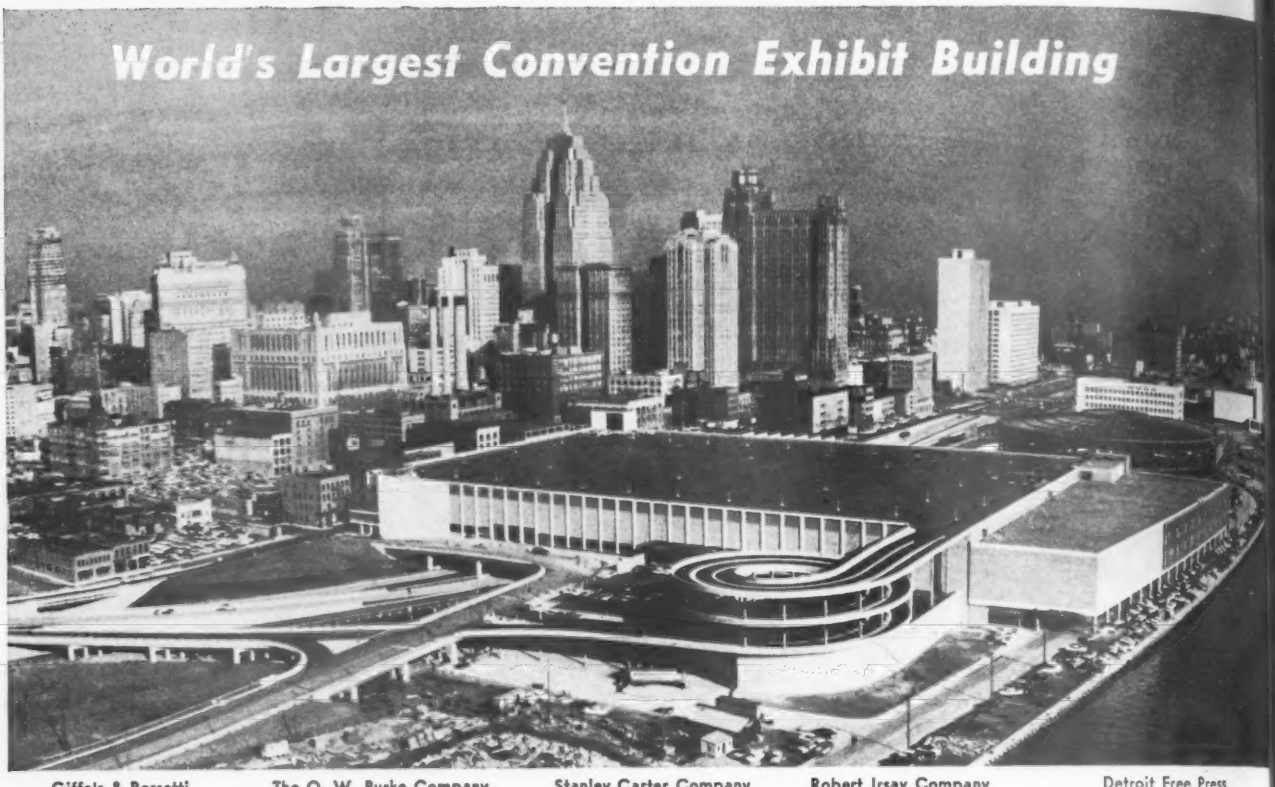
ENGINEERING LIBRARY

- *12 Ways To Collect Emissions From Electric Furnaces*
- *Source Ventilation Of Liquid Filling Operations*
- *Beryllium Dust Control . . . In-Plant Techniques*
- *What You Should Know About Respirators*
- *How To Monitor Dust In Super-Clean "White Rooms"*

ting And Cooling World's Largest Convention Hall . . . See P. 30

Detroit's Magnificent COBO HALL



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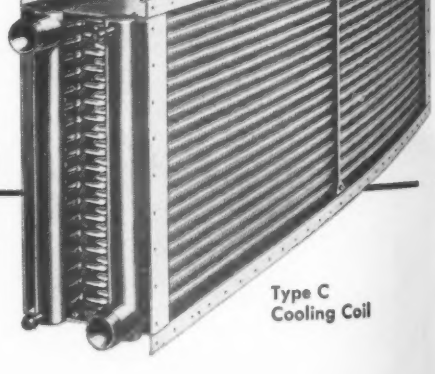
Heating Coil

Modern smooth-fin design of Aerofin coils permits ample heat-exchange capacity in limited space–permits the use of high air velocities without turbulence or excessive resistance.

Aerofin performance data are laboratory and field proved. You can safely specify Aerofin coils at full published ratings.



Type C
Cooling Coil

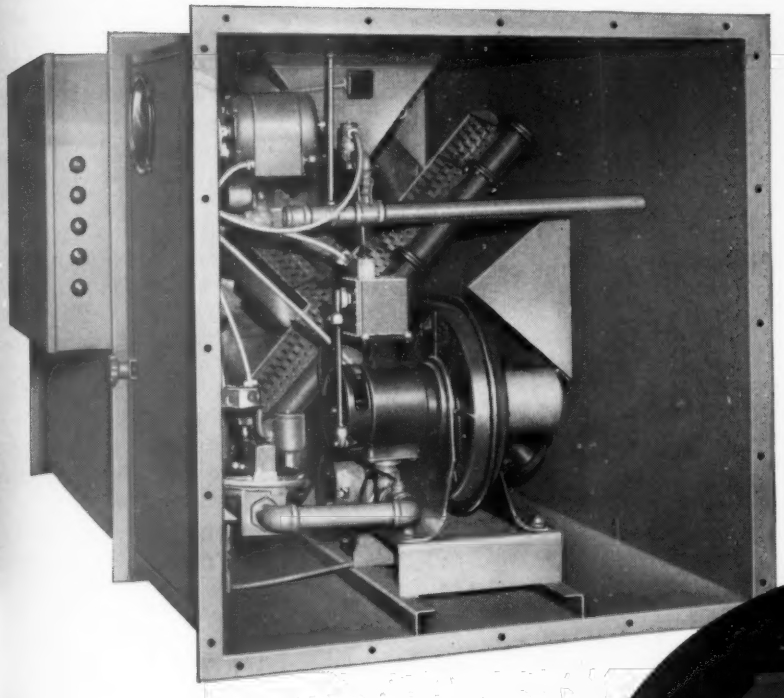
AEROFIN CORPORATION

101 Greenway Ave., Syracuse 3, N.Y.

Aerofin is sold only by manufacturers of fan system apparatus. List on request.

ENGINEERING OFFICES IN PRINCIPAL CITIES

Hartzell intake air units are custom engineered to your make-up air requirements



Hartzell Gas-Fired Air Intake Unit — available in capacities from 15,000 to 90,000 C.F.M., from 1,000,000 to 7,000,000 B.T.U.

Hartzell Steam-Fired Air Intake Unit — available in capacities from 4,000 to 36,000 C.F.M. Vertical discharge models with roof ventilator type fan housing also available.

You write the specifications for the air intake equipment that meets your exact needs — and Hartzell will supply it. Hartzell intake units are assembled to your order from standard components. You get, and pay for, only the elements you need. Direct gas-fired heat unit or steam coil — filter house and filters — shutters — outlet diffusers . . . all can be included if you need them, omitted if you don't. Fans and control systems for all operating requirements are readily available.

For complete details on the industry's most complete, most versatile line of air intake equipment, call your nearby Hartzell field office or write for Bulletin A-117.

here's a complete line of air moving equipment designed and built specifically for industry

Other famous Hartzell products include controllable and full feathering propellers for light aircraft, crop drying equipment and farm ventilating fans.

HARTZELL PROPELLER FAN COMPANY • **66 Thomas Blvd. Piqua, Ohio**
Div. of Castle Hills Corp. A Member of AMCA Engineering Offices in Principal Cities

Letters

Hospital Air Sanitation

Editor:

All hospitals have the same problem concerning the control and movement of air. Some may be larger and vary in the degree of output but basically all hospitals are concerned with the quality and purity of the air circulated throughout on a sepsis basis.

To my knowledge, there is no recommended air-filtering procedure that is standard through the industry that controls and kills the growth of bacteria in the drip pans, the humidifier pans and grids or the ducts, to say nothing of the cooling coils in various climate changers and air-handling units. When you see some of the Goldberg Installations that have been made and designed by some of the engineers in this country it makes you wonder what the industry is coming to.

I for one would welcome a filtering and air-handling system that would do 75 percent of what I mention, and am sure that hundreds of hospitals throughout the country would also join me in the welcome of such a system. Also the main factor in the control of hospital air is the cost. A hospital such as ours, (35 bed general community hospital) does not have the funds to do with as do certain phases of industry, therefore, a further need for a basis on standard system of handling and controlling air.

Paul E. Kaempfer
Plant Engineer
Southeast Missouri Hospital
Cape Girardeau, Mo.

Low Velocity Measurement

Editor:

I have read with much interest your Question and Answer section, AIR ENGINEERING, September 1959, p. 37 on the problem of measuring low velocities (150-300 fpm) in an air stream carrying water droplets. This is a very knotty problem and a difficult one to resolve.

The answer given of installing a tapered contraction with a smaller diameter measuring section where a higher velocity is attained appears to be a good solution which may give satisfactory results in

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AIR ENGINEERING

VOL. 2, NO. 9

SEPTEMBER, 1960

DEDICATED TO THE SCIENCE OF AIR POLLUTION CONTROL
AIR MOVING • AIR CONDITIONING

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Heating And Ventilating 37-acre, Four Story Exhibit Building 30
World's Largest Exhibition Hall Has Many Heating, Cooling Problems

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COVER

Cover photos show huge Cobo Hall exhibit area interior, and exterior view, lower right. Cover photos and most of those used in the article which begins on page 30, are by Lens-Art Photographers, Detroit and are copyrighted by that firm.

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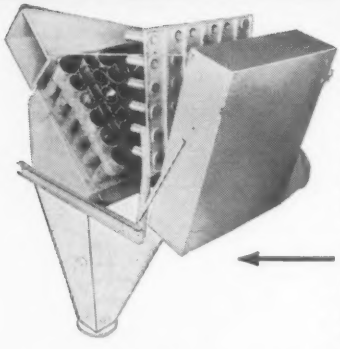
THERE'S THE RIGHT KIND OF DUSTEX COLLECTOR for every dust problem*

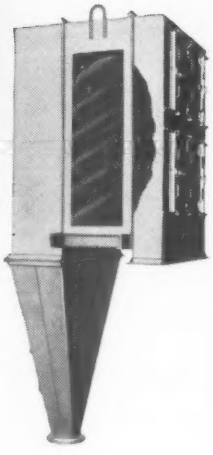


DUSTEX CENTRIFUGAL COLLECTORS →

D-584 with 100% efficiency at 14 microns

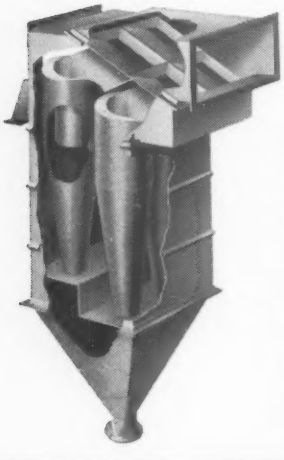
D-560 with 100% efficiency at 12 microns

for economical separation of dust from normal or high temperature gas or air.



← **MICROCLONE**

with 99.8% efficiency at 10 microns and smaller for ultra-high efficiency and installations requiring strict sanitation . . . easily cleaned and sanitized thanks to convenient hinged top tube sheet design.

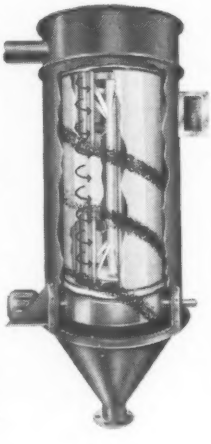


For Many Ordinary Dusts

New, Low-Cost DUSTEX "1600" brings a higher Dustex Performance to collectors in Lower Price Range.

DUSTEX ROTO-JET CLOTH COLLECTOR →

Dustex Engineering eliminates usual cloth problems through a completely new design . . . drastically lowers operating and maintenance costs.



THE BIG DIFFERENCE

IN CENTRIFUGAL COLLECTION

Dustex Exclusive Patented Design

- Unobstructed inlet plenum avoids material buildup and plugging.
- All tubes are surrounded by cleaned gases and maintained at system temperature to forestall condensation and plugging when systems are above dew point.

IN CLOTH COLLECTION

Revolutionary Dustex Advances

- Preliminary separation of dust reduces cloth load.
- No reversing mechanisms.
- Unique controlled wrap prevents cloth jamming.
- Cloth changes easier . . . less frequent.

For all Hopper and Bin Discharges

(Under Negative Pressure)

DUSTEX VACUUM VALVE

No motive power required.
No mechanical parts.
Maintenance free.
Bolt in place and forget it.

ON THE JOB DETERMINATION TEST YOUR BEST GUARANTEE

The Dustex Single Tube Determination Test, performed under actual operating conditions, provides exact data with which to specify equipment. No cost or obligation.

SEND FOR "A Simplified Test Method", illustrated booklet describing the Dustex Single Tube Determination Test in detail.

Details and specifications for every model available on request.

DUSTEX PATENTED FEATURES ARE THE BASIS FOR DUSTEX SUPERIOR PERFORMANCE

*It will pay you to learn why Dustex has so successfully handled so many process dusts where other collectors have failed.

• *The company with the big name in dust collection . .*

DUSTEX CORP.

P. O. Box 2520 • BUFFALO, NEW YORK

Letters

(Continued from page 2)

certain instances. However, this method may not be an applicable solution in all cases for the following reasons:

1. It may not be practical to install this extension stack or the economics may be such that the project may not warrant the cost of the extension.

2. If the fan is sensitive to resistance (increased static pressure) the airflow may be reduced by the extra resistance of the extension to the extent the measurement is not accurate.

3. If the water droplet concentration is heavy the pitot tube may become plugged. This however can be somewhat alleviated by using a reverse impact tube (modified pitot). This instrument is much less sensitive to plugging and is more responsive to low velocities. The instrument will need to be calibrated.

Another method which may be useful in making this type of measurements under the conditions of the problem is an indirect

(Please turn to page 59)

INCINERATION

WITH

Air Pollution Control

MORSE BOULGER INC.

BUILDERS OF THE MOST MODERN INCINERATOR PLANTS IN THE WORLD

FREE Incinerator Facts

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☐ Industrial Bulletin 184-A

Contact us, or have your architect or consulting engineer tap our 70 years experience solving Waste Disposal problems—large or small. No obligation.

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Member: Incinerator Institute of America, Air Pollution Control Assoc.

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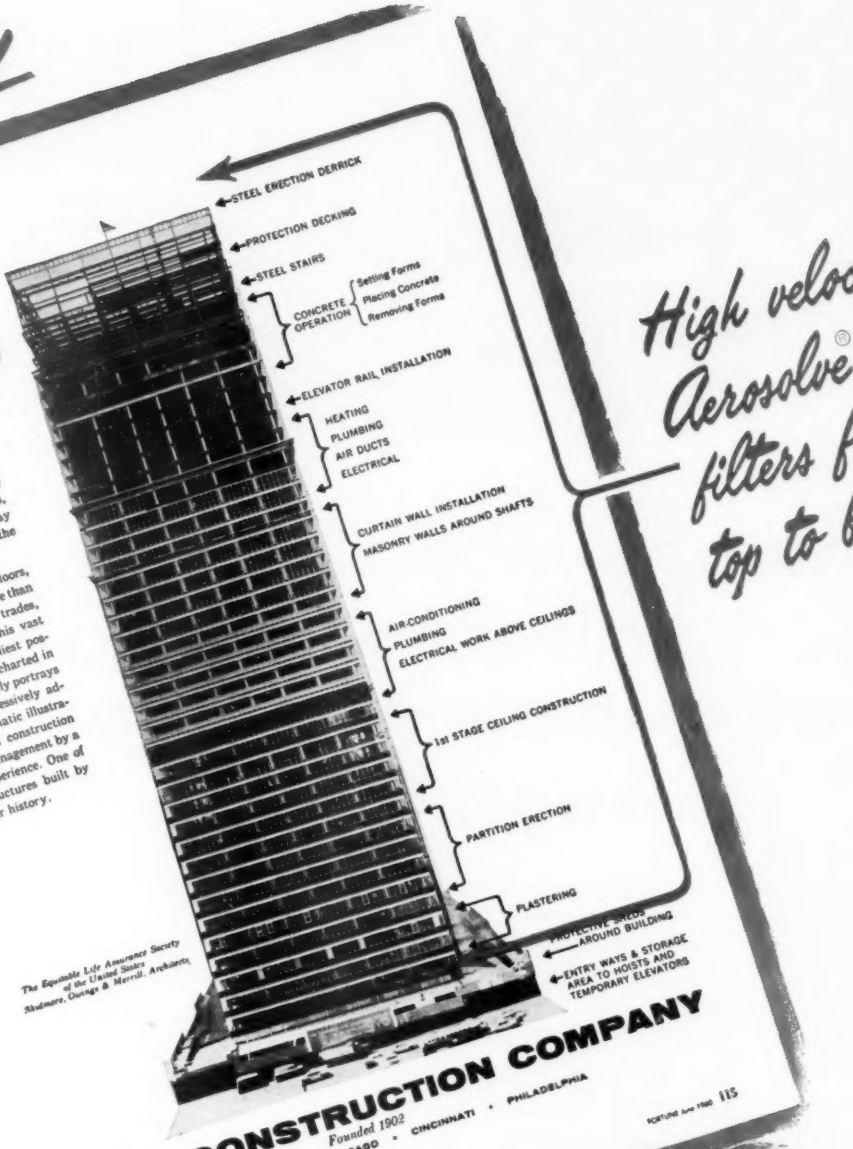

What's going on here?

Much more than meets the eye. What you see is the new building of The Equitable Life Assurance Society of the United States, in midtown New York, on topping-out day —with the traditional flag lashed to the topmost beam.

What you *don't* see, spread over 45 floors, above and below street level, are more than a thousand men, representing 26 trades, working at top speed to bring this vast project to completion at the earliest possible moment. These trades are charted in the illustration, which graphically portrays how construction must progressively advance, floor by floor—a dramatic illustration of the need for sound construction planning and for overall management by a builder with skill and experience. One of the more than 3,000 structures built by Turner during its 58-year history.

High velocity Aerosolve® 95 filters from top to bottom

TURNER CONSTRUCTION COMPANY

Founded 1902

NEW YORK • BOSTON • CHICAGO • CINCINNATI • PHILADELPHIA

FORTUNE June 1960 115

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Architects

Meyer, Strong & Jones
Mechanical Engineers

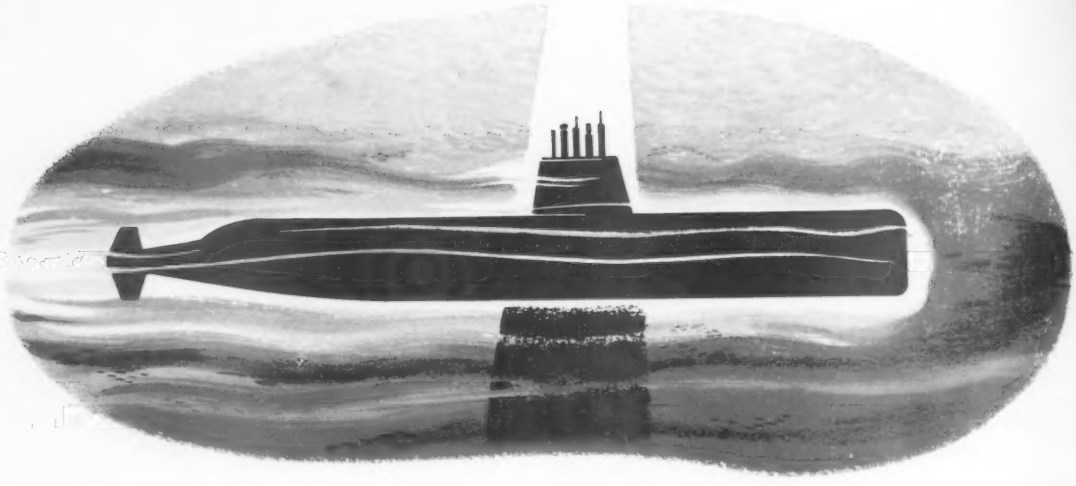
Turner Construction Company
General Contractor

Kerby Saunders, Inc.
Mechanical Contractor

We thank Turner Construction Company for permission to use their advertisement as a report on this significant project and for their skill in scheduling the smooth delivery of the Cambridge AEROSOLVE Filters which will keep 1,300,000 c.f.m. of air really clean throughout the building.

Cambridge Filter Corporation

744 East Erie Boulevard, Syracuse 1, New York



how activated charcoal solved a no. 1 problem of our atomic subs ...fresh air

The scarcest commodity aboard our atomic subs is not fisionable material—it's plain old fresh air.

Take a hundred men, hermetically seal them in a huge steel tube, then submerge the tube for days at a time.

Call the result the "Nautilus" or the "Triton" and you have an idea of the problem of building submarines to utilize the power potential of nuclear energy. They can literally stay submerged as long as the crews can stand the confinement.

Even without other contamination, just breathing would soon make the air within the tube unbearable. Then add body odors, a kitchen, a lot of complex machinery, areas where smoking is permitted, lavatories and waste tanks and you have a real problem.

To solve the problem, the Navy turned to one of the oldest and most effective methods of air purification—adsorption by Activated Charcoal.

Barnebey-Cheney Activated Charcoal filters are a standard part of the subs' air conditioning systems. Others are installed on the waste tank vents, still others in the lavatories. Odors and contaminants are trapped and held in the Barnebey-Cheney Activated Charcoal.

The same principle can be applied to heating, ventilating and cooling of homes, offices, schools, hospitals or public buildings where fresh, healthful, odor-free air is essential. Barnebey-Cheney builds a complete line of air purifiers for applications of any size, from disposable filters for window coolers to central system purifiers for the huge new Dallas Auditorium.

As in the atomic submarines, *true* air conditioning *must* include *air purification.* Activated Charcoal is the proven, practical means of accomplishing it. To learn more, write for Bulletin T352, Barnebey-Cheney, Columbus 19, Ohio.

Barnebey Cheney

AIR ENGINEERING

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EDITORIAL:

In Praise Of Industrial Hygienists . . .

FAR TOO LITTLE, in our opinion, is known about industrial hygienists and their role in the engineering of air. These often unsung protectors of the health of factory personnel can play a vital role in your plant, and you should know what they can do for you.

Industrial hygienists are a cross breed between a ventilation engineer, physiologist, chemist, biologist, toxicologist and meteorologist. They usually have at least a master's degree in their specialty from a graduate school of public health of one of our larger institutions of learning.

Knowing when and how to consult an industrial hygienist can save your company disabling payouts in compensation claims and production down time.

Most important, an industrial hygienist can help you eliminate the all-too-frequent time lag between the introduction of a potentially poisonous or hazardous substance into your plant, and the design of ventilation systems necessary to contain the fumes from this substance.

Here's a specific example as to how an industrial hygienist can help you.

A few years ago toluenediisocyanate (TDI) was introduced into the plastics field as a foaming agent for plastic foams used for auto dashboard crash pads, refrigerator foam-in-place insulation, etc. TDI is nasty stuff, with a maximum allowable concentration of only .05 parts per million parts of air. Industrial hygienists shoot for .002 ppm as an ideal situation. TDI causes severe asthma-like symptoms, its effects are cumulative and in one case at least several hundred workers became so sensitive to the stuff they couldn't get within a block of the plant and so became unemployable. This plant paid out whopping sums for compensation.

There were dozens of similar cases with respect to TDI. Unhappily we still hear about factories having TDI troubles. Now TDI, like all newly introduced chemical substances, was thoroughly researched by its manufacturer as to toxicity. Its physical characteristics as to vapor pressure curve, evaporation rate, stability, physiological effects, etc., were all published in technical and medical journals, and this data was available to the user when TDI came into his plant.

(Please turn to following page)

In Praise of Industrial Hygienists

(Continued from preceding page)

Unfortunately, very few air engineers read medical journals or have the background to evaluate physical data of a substance, its toxicity levels and other information, in terms of the exact type of ventilation system the process using the new chemical needs in his particular operation. This is a job for the industrial hygienist, for he alone has the necessary technical and professional training to relate the physical and toxic properties of a substance with the design criteria for the proper ventilation system, hood design, duct data, capture velocity, cfm needed and most efficient collector selection.

The industrial hygienist can give the air engineer the design criteria needed to design and build the ventilation system which will keep the toxic or hazardous fume or dust out of the air of the plant, at minimum expense for equipment and at maximum system performance.

The air engineer in industry, or the consulting engineer, should put himself in a position to be informed by the responsible people in his plant or in the plant of his client, about any new substance or chemical to be introduced into the process, well in advance of its introduction. If an absolutely green light cannot then be obtained from the manufacturer as to the toxicity of this substance, this is the signal to consult an industrial hygienist.

The air engineer should also be in the position where he should be informed, as a matter of course, of any process changes contemplated, well in advance to permit consultation with an industrial hygienist if necessary.

Thus, the so-called technological time lag is in our opinion an entirely unnecessary delay. An industrial hygienist is your link between the sciences of toxicology, chemistry, biology and your own field of the engineering of air for comfort, health, and safety of plant personnel. ▲▲

Eugene A. Sloane

Editor

Meetings, Courses, Expositions

East Central Section, Air Pollution Control Association, *Sheraton-Cadillac Hotel, Detroit, Sept. 22-23.*

Instrument Society of America 15th annual meeting, *New York Coliseum, New York City, Sept. 26-30.*

Fourth Western Industrial Health Conference, *San Francisco, Calif., Oct. 7-9.*

American Gas Association, 42nd Annual Convention, *Convention Hall, Atlantic City, N. J., Oct. 9-12.*

National Metal Exposition, *Philadelphia Trade and Convention Center, Philadelphia, Oct. 17-21.*

Air Pollution Control Association, West Coast Section, Second Technical Meeting, *Santa Barbara Biltmore Hotel, Santa Barbara, Calif., Oct. 20-21.*

National Electrical Contractors Association Show, *Convention Center, Las Vegas, Nev. Oct. 23-27.*

ASME-AIME Fuels Conference, *Charleston, W. Va., Oct. 24-25.*

Industrial Hygiene Foundation of America, Inc. 25th annual meeting, *Mellon Institute, Pittsburgh, Oct. 26-27.*

Air Conditioning and Refrigeration Wholesalers, Annual Meeting, *aboard S.S. Hanseatic, from Ft. Everglade, Fla., Oct. 28-Nov. 2.*

Institute of Boiler and Radiator Manufacturers semi-annual meeting, *Seaview Country Club, Absecon, N. J., Week of Oct. 31.*

The Institute of Boiler and Radiator Manufacturers, Semi-Annual Meeting, *Seaview Country Club, Absecon, N. J., week of Oct. 31.*

National Hotel Exposition, *New York Coliseum, New York City, Nov. 7-11.*

At Robert A. Taft Sanitary Engineering Center, Cincinnati, consecutive courses. *Control of Particulate Emissions Nov. 7-11; Control of Gaseous Emissions, Nov. 14-16.*

Building Research Institute Fall Conference, *Shoreham hotel, Washington, D. C., Nov. 15-17.*

Air-Conditioning and Refrigeration Institute annual meeting, *Hollywood Beach hotel, Hollywood Beach, Fla., Nov. 18-22.*

Refrigeration and Air Conditioning Contractors Association convention, *Fontainebleau hotel, Miami Beach, Fla., Nov. 20-23.*

Heat Transfer Division, ASME, 196[illegible] Winter Annual Meeting, *Statler Hilton Hotel, New York City, Nov. 27-Dec. 2.*

24th National Exposition of Power & Mechanical Engineering, *New York Coliseum, New York City, Nov. 28-Dec. 2.*

First Industrial Building Exposition & Congress, *Coliseum, New York City, Dec. 12-15.*

At Robert A. Taft Sanitary Engineering Center, Cincinnati. Course in Medical and Biological Aspects of Air Pollution, *Dec. 12-16.*

Industrial Heating Equipment Association, Inc. meeting, *Dearborn Inn, Dearborn, Mich., Jan. 23-24, 1961.*

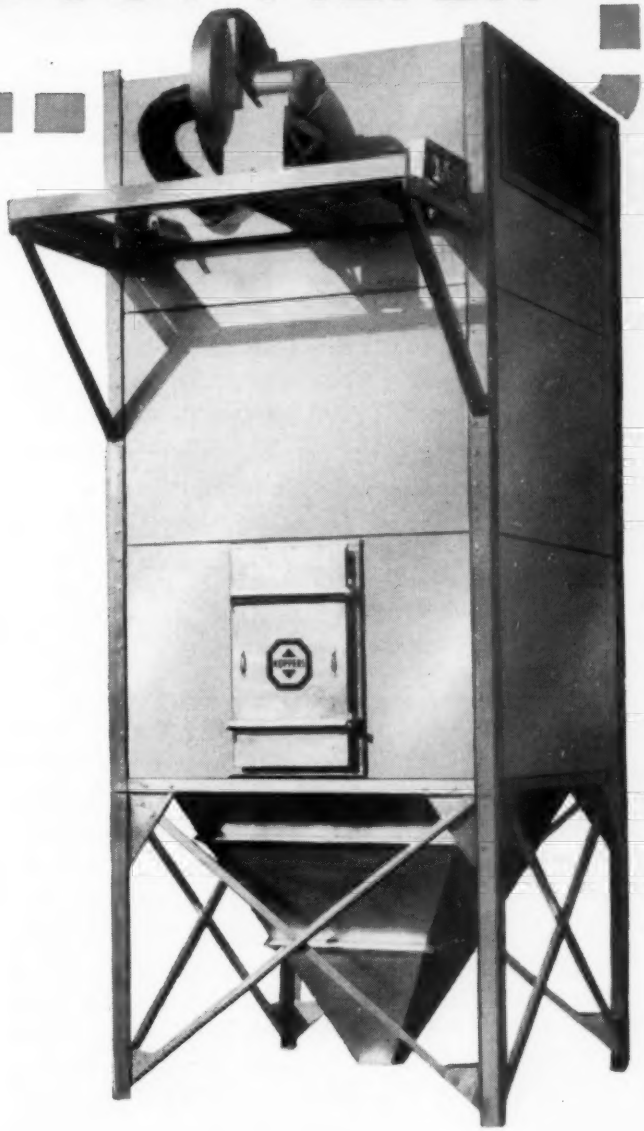
American Society of Heating, Refrigerating, and Air-Conditioning Engineers semi-annual meeting and exposition, *International Amphitheatre, Chicago, Feb. 13-16, 1961.*

National Association of Corrosion Engineers annual conference and corrosion show, *Statler hotel, Buffalo, N. Y., March 13-17, 1961.*

American Chemical Society national spring meeting, *St. Louis, March 21-30, 1961.*

Reverse-air jet filtering comes of age with the

NEW KOPPERS MODEL K AEROTURN® DUST FILTER



NEW PERFORMANCE

Highest filtering efficiency and increased capacity are benefits you get in the all-new Model K Aeroturn. Fifteen years of diversified application experience have combined to produce a dust filter offering the utmost in performance and reliability.

NEW ECONOMY

Revolutionary new self-adjusting blow rings and proven pressure controlled filter cleaning reduce wear — increase filter tube life — cut operating expense. Rugged, simplified construction virtually eliminates maintenance costs and downtime.

NEW FEATURES

Koppers Model K Aeroturn has been completely redesigned for demanding industrial service—the only new reverse-air jet filter on the market. Such features as new blow rings, new carriage drive system and simplified, standardized design help you recover more product, cost less to operate and serve you more dependably.

NOW, MAIL THIS COUPON for complete information!

KOPPERS

AEROTURN® DUST FILTERS

Engineered Products Sold with Service

KOPPERS COMPANY, INC., Dust Filter Dept.,
4109 Scott Street, Baltimore 3, Md.

Gentlemen: Please send me a free copy of your new Aeroturn brochure complete with descriptions, drawings and photographs.

Name..... Title.....

Company.....

Address.....

City..... Zone..... State.....

Watch Company Enters Radiant Heat Field

The Bulova Watch Co., Inc., has announced its entry into the field of automatic control of electric radiant heating.

Harry B. Henshel, Bulova president, said American Time Products, Inc., a wholly-owned subsidiary, has acquired exclusive rights to produce and market a line of precision automatic radiant heating controls, developed by the Harry Alfred Mulvany Laboratory of Berkeley, Calif.

In another industrial purchase, White-Rodgers Company, St. Louis, has announced purchase of the assets of the Burner Division of the Configured Tube Products Company, Bellwood, Ill., producers of burners for furnaces, incinerators and other gas burning applications.

Benson Enters Blower Market

The Benson Manufacturing Co. has announced establishment of a separate commercial blower division in Kansas City, Mo. Division will be enlarged to manufacture a wide range of new axial flow blowers for heating, ventilating and air conditioning industries.

Air Conditioned Space Helmets For Hot Industrial Jobs

For industrial workers who must work in a polluted or heated atmosphere, or both, a new air conditioned helmet has been designed by Jamieson Laboratories, Inc., Santa Monica, Calif. The white fiberglass helmet with plastic face is provided with air at controlled temperature. Filter removes airborne dusts. Entire headgear plugs into a six or 12-volt electrical system for portability with industrial car . . . for use with tractors, etc., in farming. Price: From $110 for head piece without air conditioner to $375 for complete unit.

$700-million + Market Waiting For Auto Smog Control Devices

There's a $700-million market in California just begging to be fed auto smog devices. The California State Legislature made mandatory the installation of these units as soon as models pass inspection and are approved by the state's Motor Vehicle Pollution Control Board.

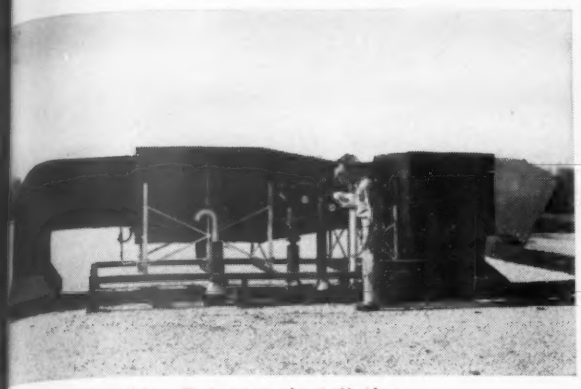
A-C Spark Plug Division of General Motors Corp., has just announced a crankcase blow-by unit which is said to retail, installed, for from $10 to $18, to control up to 40% of total emissions.

Other cities are looking at California's efforts to control auto exhaust emissions. If California can, on a practical basis, keep auto emission under control by making mandatory the purchase of devices which will work, other states and individual cities are planning to follow suit.

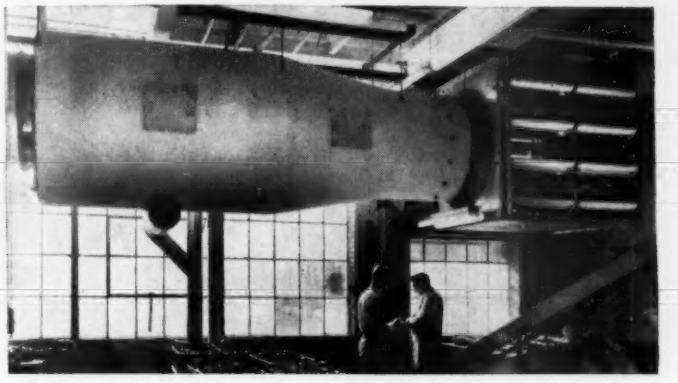
"White Room" Particle Counter Can Spy On Enemy Troop Formations

A novel technique for monitoring dust particles in "white rooms" used for assembly of dust-sensitive instruments and equipment, has been proved effective in monitoring personnel or vehicular movement.

The particle counter, developed by Armour Research Foundation, Chicago, measures concentration and size distribution of airborne dusts. The counter, in a drone plane, can sample dusts, from which specialists in fine particles research can tell number of troops marching or how many vehicles are moving in a specific area.

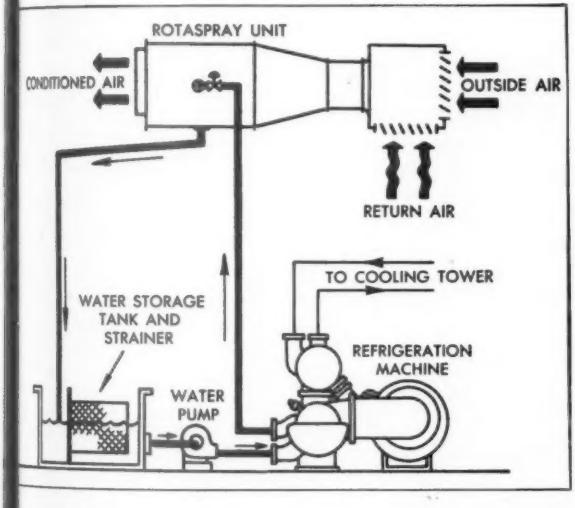


Roof-top Rotaspray installation



Ceiling-mounted installation

First major advance in industrial air conditioning in half a century...



taspray units are self-cleaning and require no filters. A ngle refrigeration machine with chilled water storage tank d filter station will handle a multiple-unit system with units cated at many remote points. Each Rotaspray Weathermaker it provides individual control of temperature and humidity.

*THE CARRIER ROTASPRAY WEATHERMAKER SYSTEM**

Here's a major breakthrough in industrial air conditioning—the revolutionary Carrier Rotaspray System. After five years of actual operation on scores of different applications, it has proved itself superior to past systems three important ways. It provides better, more precise control. It lowers construction and maintenance costs. It occupies less space.

Notice the Rotaspray units shown here. Operating at high air velocity (2600 fpm), they are only ⅓ as large as conventional air-treating apparatus for the same capacity. Each provides automatic, positive control of temperature and humidity in the area it serves.

Other advantages: Rotaspray units are self-cleaning, require no filters and are made of stainless steel for long life. Compact and light, they can be hung from the ceiling, put on the roof or suspended outside the wall. No housing required. Five sizes: 10,500 to 45,000 cfm.

Whether a job involves air conditioning for a new plant or for modernization, you'll find it well worth while looking into the new Carrier Rotaspray System. For complete details, write Carrier Air Conditioning Company, Syracuse 1, New York. In Canada, Carrier Air Conditioning Ltd., Toronto.

** Trademark Reg. U. S. Pat. Off.*

Carrier Air Conditioning Company

A DIVISION OF CARRIER CORPORATION

determine
DUST PARTICLE
SIZE DISTRIBUTION
below 60 microns

Micro-Particle Classifier No. 6000 with totally enclosed 220 volt, 3 phase motor operates at 3500 rpm. 16" high x 16½" diameter

with the
DIETERT-DETROIT
MICRO-PARTICLE
CLASSIFIER

Quickly determine sub-sieve particle sizes with scientific accuracy. The No. 6000 Dietert-Detroit Micro-Particle Classifier is widely used throughout industry for pre-testing dust collector needs, for determining the separating efficiency of air cleaners, for particle size control in many industrial processes and for scientific studies of fine materials. Mineral flours, metal powders, abrasives, fly ash, chemicals, drugs, etc., can be classified into eight fractions below 60 microns, (materials above 60 microns can be retained for sieve analysis). An eight-fraction analysis can be completed at the rate of 15 minutes per fraction by unskilled operators. Fractions are precisely defined and may be retained for accurate study. Gentle sifting action prevents particle fracture—assures accuracy and reproducibility.

8-page catalog mailed on request

HARRY W. DIETERT CO.
CONTROL EQUIPMENT
9330 Roselawn Detroit 4, Michigan

Send me 8 page Micro-Particle Classifier bulletin—without obligation.

NAME_____
COMPANY_____
ADDRESS_____
CITY_____ STATE_____

NEWS of the Industry . . .

Cincinnati Report Gives Odor Complaint Data

The 1959 Annual Report of the Cincinnati Bureau of APC and Heating Inspection touches upon a study made to ascertain if meteorological conditions had any effect on the number of odor complaints. Data, gathered June through Sept., 1958, was compared with local weather conditions. Some interesting facts came to light:

More odor nuisances and complaints occurred on Saturday than any other day. Statistics: 45 percent of odor nuisances occurred between 6 to 12 p.m.; 91 percent odor complaints occurred when the temperature was between 65° and 89° F.

Atmospheric pressure, relative humidity, and wind velocity had no effect on the number of complaints. On the other hand, decreasing temperature, increasing pressure, and increasing relative humidity upped the number.

Also considered in the Report is the method used for detecting odor sources. "A most practical method was devised by means of the use of helium filled balloons, a map of the suspected source and its surrounding territory, and a directional compass.

"Odor locations and their strengths were marked on a map. Small balloons . . . were then r leased and their path of flight w then read in degrees from nort A line was then drawn on the m showing the direction of the flig Reversing the path showed t suspected source. When two more of these observations led the same spot, the source was p pointed."

Plume Evaluation Program Underway

Prior to enforcement of its new regulation, effective Jan., 1961, enforcing limits on visible smoke emissions, the Bay Area Pollution Control District, San Francisco, Calif., is training men for a special Plume Evaluation Unit.

Scheduled for intensive training are officials representing fire, health, building, zoning and public works departments; school districts, industry and business. Training includes on-the-spot observations.

The Unit was patterned after an earlier model developed by the Los Angeles APCD from 1949 to 1951. Refinements and improvements made are based on the original Los Angeles model, including the mobility obtained by placing the new Unit on a trailer.

APCA Announces Cleaner Air Week

With the view in mind of p moting public understanding nec sary to enlist a community-wi approach to pollution control, t APCA, for the twelfth year, sponsoring "Cleaner Air Week Oct. 23-29. Local committees many cities are the operating un of the campaign.

The objects of the APCA a threefold: to center attention local problems, to create an awar ness of control progress, and maintain a community approa to pollution control.

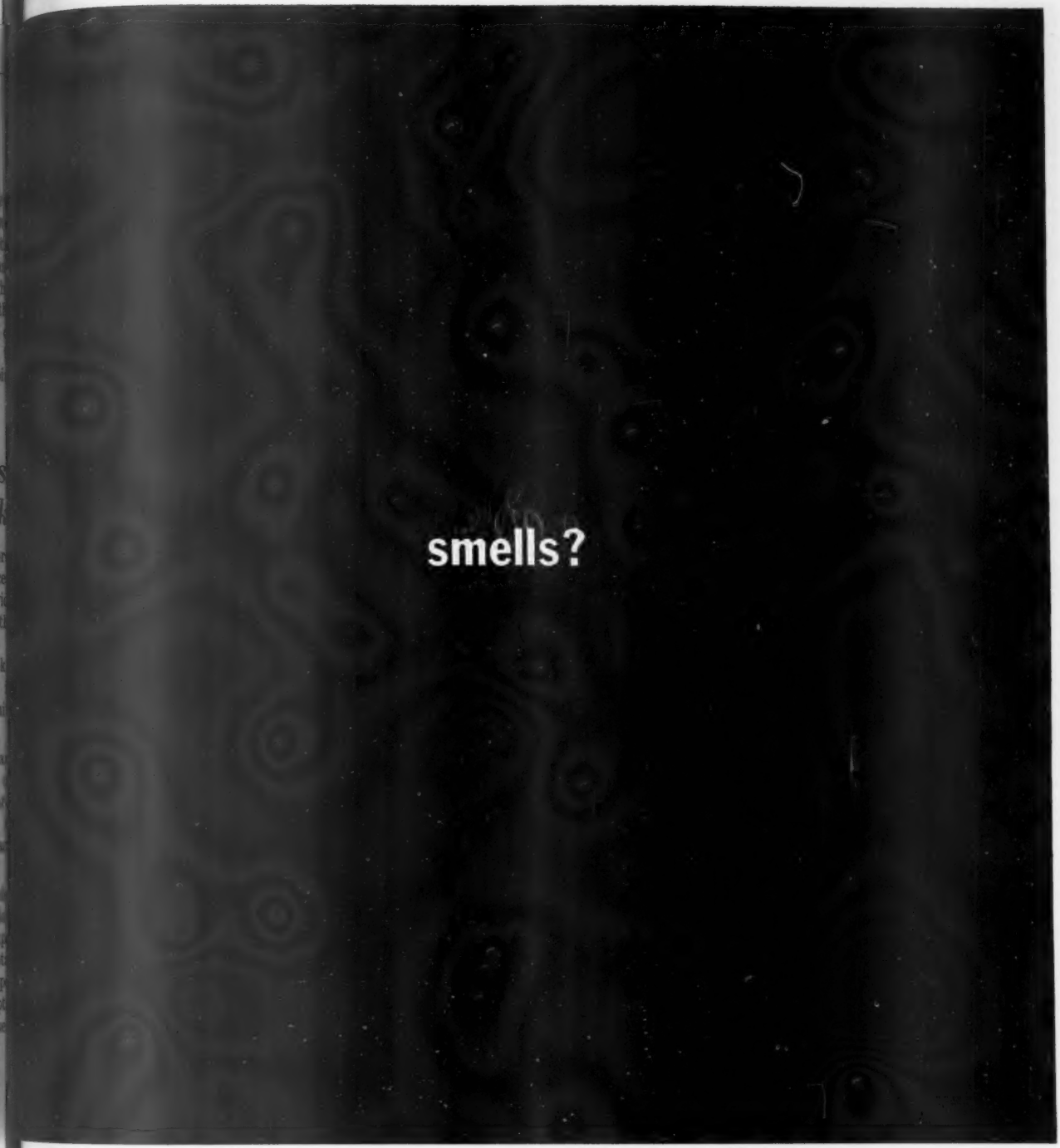
The national committee provid continual promotional servi without cost, to local CAW group Bulletins include, for local adapt tion and use, suggestions for sp cial events, tv and radio script speech material, and news releas

Heat Illness Can Mean Death

Significant findings, reported i the article "Heat Illness" in th July issue of *GP*, published by Th American Academy of Genera Practice, an association of phys cians engaged in general practic of medicine and surgery, indicat that heat is a killer.

Further, it was found that o the four most common forms o heat illness—hyperpyrexia, stroke prickly heat, anhydrotic heat ex haustion—most metropolitan are victims developed symptoms in in sufficiently ventilated and cooler enclosures rather than out in th sun.

(Please turn to page 1



CALL ON RHODIA "ODOR ENGINEERING" TO SOLVE YOUR MALODOR PROBLEMS IN PLANT OR PRODUCT

Rhodia Inc. is the world leader in industrial odor control and reodorization technology and a primary producer of industrial aromatic chemicals. It offers fully qualified consultation service anywhere in the United States without cost or obligation.

Rhodia Alamask products are in use in virtually every industry to control malodor problems of stack gases, exhaust fumes, and plant effluvia effectively and economically. Rhodia "odor engineering" has also created greater market acceptability for wide range of finished products through the neutralization of unpleasant odors and/or the addition of pleasing and appropriate fragrances. Why not call or write Rhodia today about your problem, or use the coupon for additional information.

89-2

RHODIA INC.
60 East 56 St.
New York 22, N. Y.

Gentlemen:
Please send me Rhodia literature. My problem is:

(please give specifics)_____

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NAME:_____

ADDRESS:_____

CITY:_____ STATE:_____

RHODIA INC. 60 East 56 Street, New York 22, N. Y. (Phone: PLaza 3-4850)

News of the Industry . . .

(Continued from page 12)

Chicago Makes AP Progress, Slowly

Since May 1959, when Chicago's new air pollution control ordinance went into effect, progress has been slow and complaints many, according to the Chicago *Daily News,* which is waging a vigorous campaign for cleaner air. Advances and set-backs, mentioned by the paper, include:

- A new $100,000 air pollution research laboratory was created to gather data on air pollution, but, director of the department, Thomas Carey, complained of being unable to hire a chemical engineer at the budgeted salary of $6,768 a year.
- Three boards, yet to be created are required to give the new ordinance full effect: a control committee, a technical advisory committee, and an appeals board.

In addition, more smoke inspectors are needed on an around-the-clock basis, but low salaries offer little attraction.

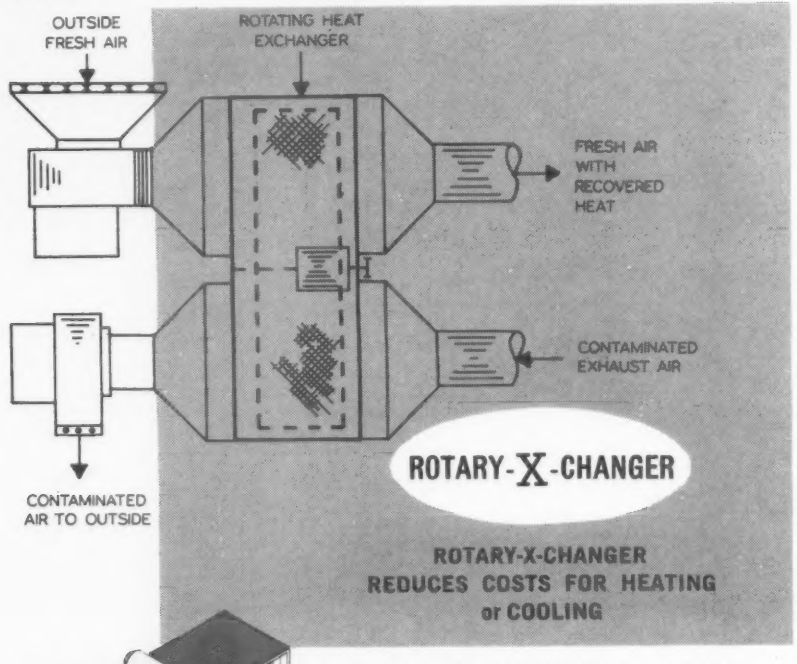
Citizen attention to the problem of air pollution is not limited to the conscientious *News.* Over 100 neighborhood volunteers in the Hyde Park-Kenwood area are serving as "spotters" for sources of air pollution, and, at the request of the mayor, all citizens are urged to report violations in their vicinities.

Under the new ordinance, in industrial heating plants, Ringelmann No. 4 and 5 smoke is prohibited and No. 3 is limited to a maximum of six minutes per hour for pre-ordinance heating plants and two minutes for new plants in normal operations.

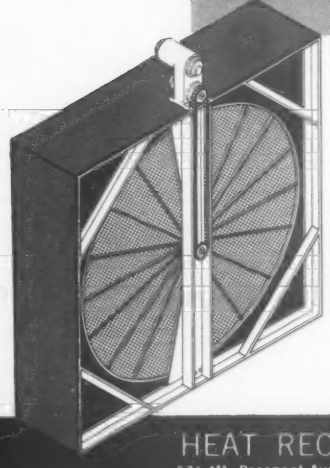
For new industrial equipment installed after the ordinance was passed, No. 2 smoke is limited to 12 minutes per hour in normal operations. There is no restriction on No. 1 smoke.

This simple "Air to Air" principle means savings to

Hospitals
Laboratories
Manufacturing Plants
Foundries
Mines
Schools
Textile Mills
Printing Plants
Bowling Alleys
Industrial Incineration
Drying Ovens
etc.



ROTARY-X-CHANGER
REDUCES COSTS FOR HEATING
or COOLING



The ROTARY-X-CHANGER is a highly efficient heat exchanger for recovering heat from contaminated air that must be exhausted and transferring this heat to a fresh air supply. Conversely, heat from fresh air can be transferred to exhaust air from air conditioned or refrigerated spaces, pre-cooling the incoming fresh air.

The ROTARY-X-CHANGER will recover more than 80% of wasted heat or reduce the fresh air sensible cooling load by more than 80% — WITH RESULTANT SAVINGS IN FUEL AND POWER.

Complete data including specifications and performance furnished on request.

HEAT RECOVERY CORPORATION
671 Mt. Prospect Ave., Newark 4, N. J. Tel: HUmboldt 3-6468
Territories Available for Qualified Manufacturers Representatives

Weather Bureau Offering AP Data

A special program of experimental forecasts of air pollution potential for all portions of the U.S. east of the Rocky Mountains is available to control or research units. The forecasts, originating from the Robert A. Taft Sanitary Engineering Center, Cincinnati, O., provide opportunities to study local problems and meteorological influence on pollution conditions.

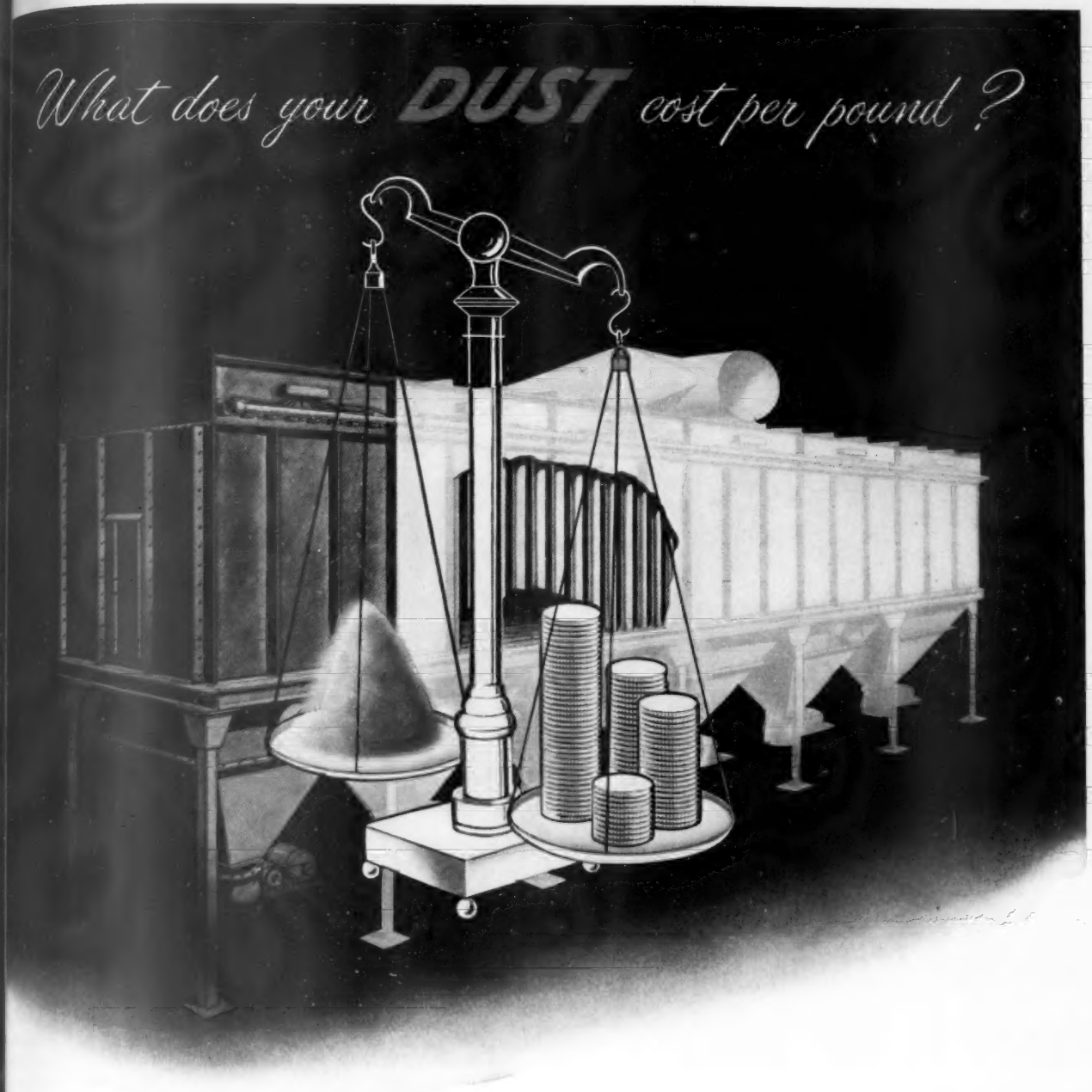
To be notified of these forecasts, arrangements must be made with the nearest Weather Bureau station. Forecasts will be issued only when meteorological indications warrant. They are not being offered as a routine Weather Bureau function, due to the experimental nature of the project.

Mead Corp. Builds Sampling Stations

The Mead Corp., Marion, O., has begun the erection of several air measurement and sampling stations, as part of its research program into local atmospheric conditions. The stations are designed after models used by other communities. Gathered data will be correlated by Mead scientists to find sources of existing air problems.

(Please turn to page 16)

What does your **DUST** *cost per pound?*

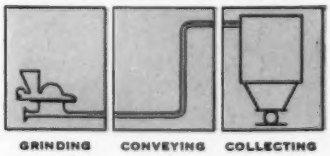


If your present dust control system is not delivering maximum efficiency, you may be paying an exorbitant price for dust. It's a mighty expensive item when you consider the damaging effect on equipment, on employee morale, on general plant appearance and community relations. The most practical and *economical* solution of any nuisance dust problem is the MIKRO-PULSAIRE Collector, now available in new flexible modular units designed to meet any required capacity however large or small . . . attested recovery efficiency 99.9% plus . . . absolutely no moving parts, internally or in the gas stream . . . 4 or 5 times the capacity of conventional bag houses per unit of cloth area. For the toughest nuisance dust collection jobs, call on our engineering staff, and the MIKRO-PULSAIRE.
Ask for Bulletin 52A-1.

MIKRO-Products
PULVERIZING MACHINERY COMPANY
1 Chatham Rd., Summit, N. J.
A Division of American-Marietta Company

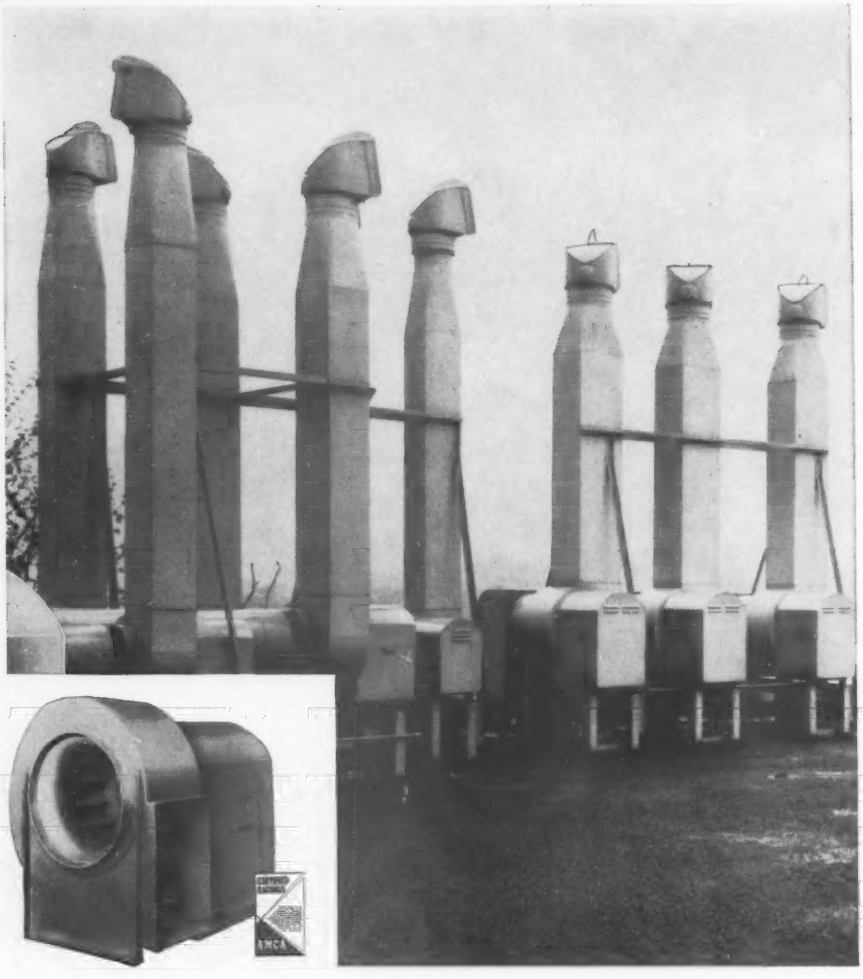
SPAN THE GLOBE

PROCESSING SYSTEMS



REPRESENTATIVES throughout the United States, Continental Europe, British Isles, Canada, Mexico, Central and South America, West Indies, South Africa, India, Japan, Philippines, Australia and New Zealand.
MANUFACTURING FACILITIES: United States, Canada, Continental Europe, British Isles.

ANOTHER PEERLESS ELECTRIC SPECIAL BLOWER APPLICATION



Peerless Electric Blowers Remove Fumes At Gulf Research Center

Shown here are Peerless Electric Backward Curve Blowers applied to exhausting flammable and harmful vapors from the cleaning room of Gulf's Automotive Products Evaluation Laboratory. These heavy duty blowers have arc-welded wheels with cast iron hubs and non-slip taper lock bushings.

Peerless Electric can engineer a blower for *every* important air moving job. Units, similar to this, are available for continuous supply and exhaust duty in air conditioning systems of schools, hospitals, public buildings and industrial installations.

On your next job, let Peerless Electric engineer your air moving needs. Write to: *Peerless Electric Division, H. K. Porter Company, Inc., W. Market Street, Warren, Ohio.*

PEERLESS ELECTRIC DIVISION

PORTER

H. K. PORTER COMPANY, INC.

PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.

NEWS

(Continued from page 14)

Shell Molding Percentage Up

Shell molding is said to use about 80 percent less sand than conventional foundry operations, and therefore dust concentrations within the foundry atmosphere would be reduced. A study made by the Michigan Department of Health, Division of Occupational Health, as reported in the May issue of A.M.A. Archives of Industrial Health, points out that on the contrary, shell molding operations cause higher dust concentrations . . . with 45 percent of the dust concentions greater than 20 MPPCF.

Article states that 590 foundries in the U.S. do shell molding, with a total employment of 25,000 workers.

Hazards due to air contaminants were listed as:

Sand . . . about same silicosis hazard as for conventional foundry operations.

Combustible resin. . . . High concentration of combustible resin at sand conditioning by dry-blending poses dust explosion hazard, according to the article. Authors strongly recommended removal of resin-sand dust accumulations on rafters by vacuum cleaning rather than by blowing down with jets of compressed air.

Resins. . . . Irritating gases from breakdown components of resins was given as cause of chronic irritation to mucosa and impairment of lung-cleaning mechanism, when low-level concentrations exist over long period of time.

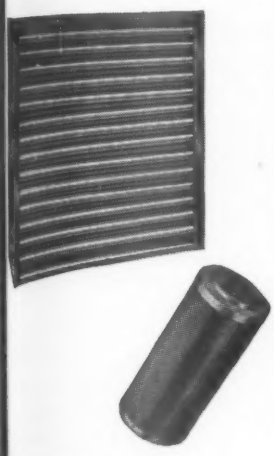
The authors, George E. Tubich, Irving H. Davis, and Bernard D. Bloomfield, all of the Michigan Department of Health, made the following recommendations for controlling dust and solvent vapor exposure:

(Please turn to page 20)

Use Communications Center, page 51, for requesting more information about articles, advertised products, literature, and for comments about any of the editorial material in this issue of AIR ENGINEERING.

HOW DOREX AIR RECOVERY annually cuts air conditioning costs by 78%

Over a 20-year period, the dollar difference is incredible, the penalties of owning and operating cost are tremendously reduced . . . if an air conditioning system uses DOREX to recover already conditioned air rather than use 100% outside air.



DOREX is designed in two basic types—C Cells and H Canisters. Because of their arrangement flexibility, canisters are especially suitable where installation space is limited or irregular.

ESTIMATED DIFFERENTIAL OF OWNING AND OPERATING COSTS, OUTDOOR AIR vs RECOVERY AIR FOR 1000 CFM

ITEM		OUTDOOR AIR	RECOVERY AIR
	ANNUAL FIXED CHARGES		
1.	Amortization, 20 years, cost per year	$ 78.10	$ 17.50
2.	Interest rate, 4 percent [(20 yr + 1)/(2 × 20 yr)] × 0.04 × initial cost	32.00	7.35
3.	Taxes and insurance (neglected)	0.00	0.00
4.	Total annual fixed charges	110.10	24.85
	ANNUAL MAINTENANCE COSTS		
5.	Repairs, refrigerating equipment $1.20 per ton	4.56	
6.	Refrigerant 0.44 per ton	1.67	
7.	Oil and grease 0.12 per ton	0.46	
8.	Repairs, heating gross	5.00	
		11.69	
	ANNUAL SERVICE COSTS		
9.	Electric power, refrigeration (0.746 × hp × cooling hours)e* = 3220 kwhr		
10.	Cost of electric power 1.5¢ per kwhr		
11.	Refrigeration power costs (Items 9 and 10)	48.20	
12.	Water at 11 cents per 1000 gal (neglected with cooling tower)		
13.	Heat requirement 4.5 × 1000 × 11.7** × 2200/e* = 165,000MBtu		
14.	Gas cost, $1.00 million Btu		
15.	Heating cost (Items 13 and 14)	165.00	
16.	Recovery fan power, 0.0001573 × 1000 head = 0.063 hp		
17.	Recovery fan power, [0.746(16) (2200 + 810)]/e = 188 kwhr		
18.	Recovery fan power costs (Items 10 and 17)		2.82
19.	Labor to change recovery cells		2.00
20.	Freight to ship used and recharged units		10.00
21.	Regenerate, recover cells		35.00
		213.20	49.82
	SUMMARY		
	Annual fixed charges	110.10	24.85
	Annual maintenance costs	11.69	
	Annual service costs	213.20	49.82
	Total annual owning and operating costs	334.00	74.67
	Annual savings with air recovery		260.32
		334.99	334.99

*Efficiencies are taken in items 9 and 13 as 70 and 75 percent respectively.
**Difference in enthalpy, Btu per lb of dry air, between inside and outside, for average winter conditions.
From a paper by Warren Viessman, Heating, Piping & Air Conditioning—Sept. 1959

By recovering used, already conditioned air, extracting from it the accumulated impurities, and converting it to original freshness, DOREX brings about maximum economy in air conditioning. Detailed information on the unique DOREX process and equipment is available. Simply request—on your letterhead, please—Bulletin 108A and "Air Conservation Engineering". Contact the representative near you or write to Connor direct.

CONNOR ENGINEERING CORPORATION

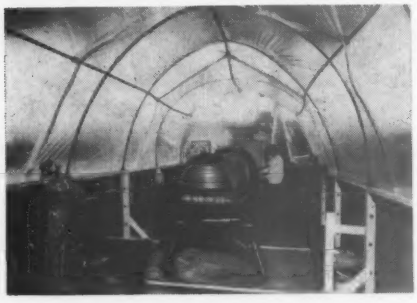
DANBURY • CONNECTICUT

CONNOR ENGINEERING CORPORATION dorex® air recovery

. . . the most experienced professionals in air recovery and purification.

NEWS of the Industry . . .

(Continued from page 16)



• • •

Super Clean-Room Used for Tube Welding

Two important factors in welding various components of heat exchanger equipment tube bundles are cleanliness and space adaptability. Regarding the latter, some tube bundles measure 40, or more, feet long. As a solution to this problem, engineers at American Standard Industrial Division have designed a portable, expandable clean-room to accommodate virtually any length. The clean-room is constructed with hardboard side panels and a heavy-duty polyethylene semicircular top, and may be placed on plant floor, *top*. Room is expandable in six-foot lengths, *below*. A fan on the inlet vent draws air through a filter into one end of the room, and another, at the opposite end, forces air out, maintaining continuous flow of contaminant-controlled air. When not in use, room is easily dismantled in sections.

Steel Corp. Plans 2 Oxygen Furnaces

Plans for a two-furnace oxygen steelmaking shop to be built in Detroit have been announced by the National Steel Corp. Auxiliary equipment will include electrostatic precipitators to remove solids from gases generated in the steelmaking process.

Calif. Oil Industry To Spend Millions

• California oil industry is to contribute 27 percent of a proposed $250 million, ten year, air pollution research program. The program will, among other things, determine the degree to which refining and oil industry operations contribute as pollution factors. Federal, state and local governments are to make up the remaining 73 percent.

The *Oil and Gas Journal* says that the estimated current level of $11,700,000 annually would be expanded, during the seventh year of the program, to $30 million. Much of the research is to be concerned with the Los Angeles area, where the proverbial "smog" creates an estimated agricultural damage of $5 million yearly.

• Los Angeles County's oil refineries are faced with a possible $40 million expenditure next year, necessary to meet requirements of the second phase of the APC District's Rule 63. The ruling, making it illegal to sell gasoline in the county with an olefin content in excess of a 20 bromine count, becomes effective Jan. 1, 1962. In the past decade, the refineries have spent approximately $50 million for AP control.

Pollution Complaint$

Solvay, N. Y.—Officials of Solvay Process, Crucible Steel Co., Pass and Seymour, Frazer-Jones and Stanton Foundry have reported progress in smoke abatement.

• • •

Beacon City, N. Y.—Residents of this city have complained about fly ash from Braendly Dye Works. Firm has stated efforts are being made to keep emission from their 150 ft. stack at a minimum, but varying steam loads cause intermittent firing operations.

• • •

Lackawanna and South Buffalo, N. Y.—To eliminate complaints of area residents of heavy smoke emissions, Bethlehem Steel Corp. plans to spend about $5-million for air pollution control equipment, according to Lee I. Dickinson, fuel manager for the Lackawanna plant. Red ore dust has allegedly sifted down in heavy quantities from new oxygen lance furnace operations.

• • •

Miami, Fla.—Open burning has caused discoloration of newly painted boats, according to a suit by a boat builder in Circuit Court here. Court, in a $50,000 damage suit, has also been asked to enjoin burning of scrap metal and junk. Defendants are: Sunshine State Salvage and Equipment Co.; United Metal and Steel Corp.; Atlas Iron & Metal Corp.; and Al's Auto Parts and Salvage, Inc. Suit was filed by Jones Boat Yard, Inc.

Lee's Summit, Kan. — Jackson County planning commission has heard complaints against Union Construction Co., by area residents, against operating asphalt plant. Residents allege operation creates smoke and fumes.

• • •

Portland, Ore. — Zidell Machinery and Supply Co., shipwreckers, stated that if the new Portland air pollution control law forbidding open burning were enforced to the letter, the firm would abandon the shipwrecking business. Firm burns wooden flight decks from aircraft carriers being scrapped. Marvin Schnitzer Machinery Co. which burns insulation off scrap wire, wants ban on open burning imposed gradually, over period of years.

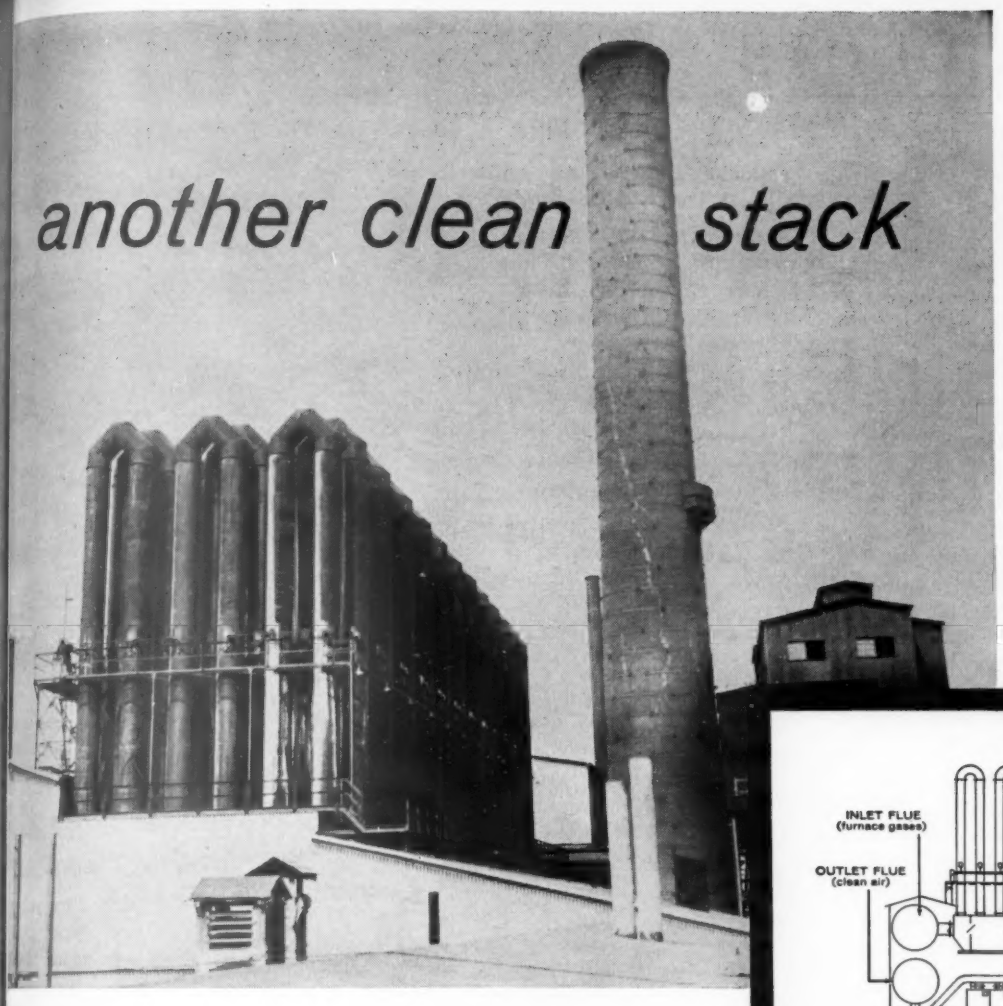
• • •

Chicago, Ill.—City is preparing to file suit against General Iron Industries of Chicago for burning over 60 cars nightly in alleged violation of city air pollution ordinance.

• • •

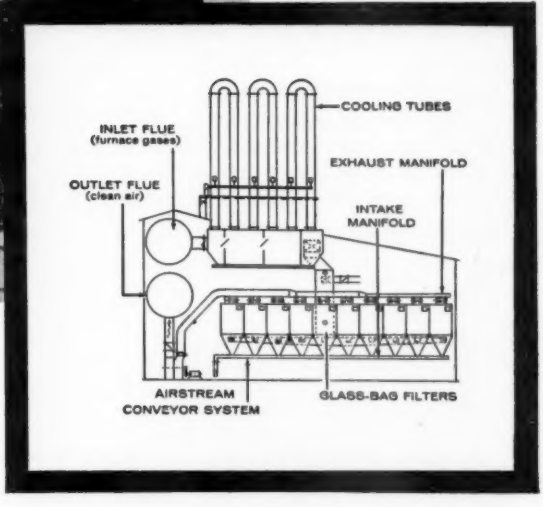
Louisville, Ky. — Area residents have complained about odor from Catalysts & Chemicals, Inc., which allegedly cause shortness of breath. Firm's president has stated fume control equipment has been installed.

Use Communications Center, page 51, for requesting more information about articles, advertised products, literature, etc.



(Left) Cooling tubes atop Glass-Bag Filter housing lower furnace gas temperature from 800°F. to 450°, a full 150° below maximum advisable operating temperature. Clean stack proves that filter removes all visible dust.

(Below) System consists of 12 ten-compartment Glass-Bag Filters. Gases at 800° are blown from electrostatic precipitator to cooling tubes which discharge to filter system, resulting in daily collection of about 35 tons of material.



..."trade mark" of the Dracco Glass-Bag Filter

Freedom from hot, corrosive dust created by metallurgical processes is one of the many benefits of using Glass-Bag Filters. The clean stack shown in the unretouched photograph testifies to the effectiveness of the Dracco system at Hudson Bay Mining & Smelting Co., Ltd., Flin Flon, Manitoba.

Here is what the system does for Hudson Bay:

- **handles 450,000 cfm of mixed reverberatory furnace and converter gases at 450°F.**
- **recovers approximately 35 tons of valuable metal oxide dusts daily.**
- **maintains operating temperature to prevent condensation of exhaust gases and formation of corrosive acid dews.**
- **eliminates air pollution**
- **reduces cooling equipment requirements, and costs, by 50% over conventional methods.**
- **provides low-maintenance operation and gentle bag cleaning with SWING-CLEAN.**

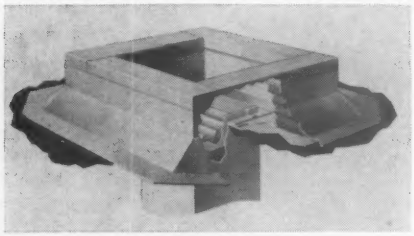
Glass-Bag Filters, the most advanced equipment now available for fighting air polution and hot dust, have been proved-in-performance in the metallurgical, chemical and cement industries. Virtually 100% collection efficiency is maintained at temperatures to 600°F. Maximum bag life is assured by either of two patented cleaning devices: (1) a mechanism for dust removal by sonics and (2) SWING-CLEAN, gentle swaying action.

For full details on how Glass-Bag Filters can help you lick that hot dust problem, write: Dracco Division of Fuller Company, Harvard Avenue and East 116th Street, Cleveland 5, Ohio.

DRACCO *airstream* conveyors
dust control equipment

FULLER COMPANY GENERAL CONTRACTORS

New PRODUCTS



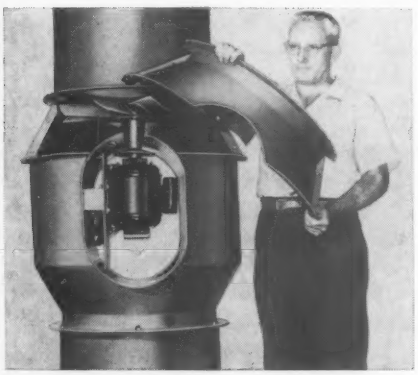
Prefabricated Roof Curb

Purpose: To provide time- and cost-saving on installation of roof ventilators.

Features: Prefabricated units constructed of heavy gauge painted steel, joints welded, base and separate corner cants reduce possible leak points, prevent tearing roofing materials. Units have full fibreglas insulation between double sheet construction and wood top curb for easy ventilator mounting.

Fits roof openings from 10 in. x 10 in. to 36 in. x 36 in. with outside top curb dimensions of 20 in. x 20 in. to 52 in. x 52 in. Each unit is assembled before shipment.

Source: Swartwout Fabricators, Inc., Dept. AE, Kokomo, Ind.



Duct Fan With Removable Cone

Purpose: To reduce maintenance and down time in plants using duct fans to exhaust air containing abrasives, chemicals or other materials which cause excessive wear or corrosion on fan blades.

Features: Motor or fan wheel can be removed from the duct without removing "Bifurcator" or disassembling ductwork. Removable cone is said to be more than an access door . . . entire half of cone unbolts and comes off.

Source: DeBothezat Fans Division, American Machine and Metals, Inc., Dept. AE, East Moline, Ill.

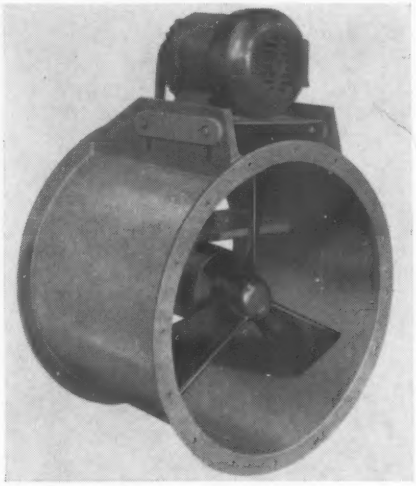
Plastic Membrane Filter

Purpose: Removing submicron particles from fluids and gases.

Features: Filter is thin plastic with uniform holes occupying 80-85 percent of the filter volume. No fibres to dislodge and contaminate downstream.

Available in 14 different types, with a choice of pore sizes from 0.1 to 10 microns. Three grades for different uses: laboratory, process and solvent resistant.

Source: Gelman Instrument Co., Dept. AE, 106 North Main St., Chelsea, Mich.



Vinyl Tuberaxial Fans

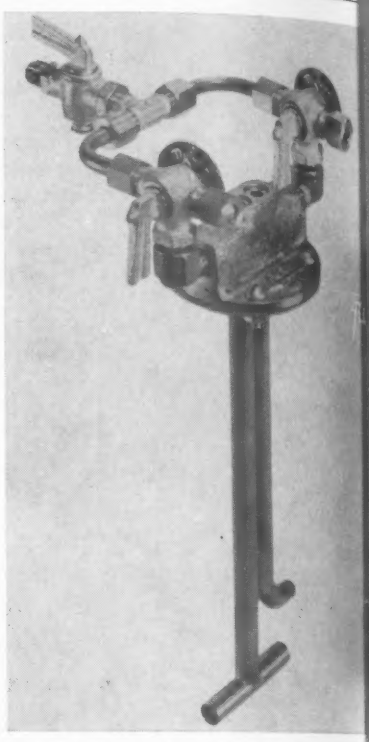
Purpose: To handle highly corrosive air.

Features: Fans may be obtained in sizes from 16 in. to 36 in. and with air deliveries ranging up to 25,000 cfm. All parts in contact with the airstream are corrosion proof. Entire fan drum assembly, including mounting flanges, bearing support, motor support, and belt tube, is fabricated of solid vinyl and welded air-tight.

High-efficiency airfoil section propellers may be either polyvinyl chloride coated or #347 stainless steel. The bearing assembly incorporates a stainless steel shaft with labyrinth flinger to keep corrosive condensate from the bearings.

Coatings are high-voltage spark tested to detect any possible flaw.

Source: Propellair Division, Robbins & Myers, Inc., Dept. AE, Springfield, Ohio.



Pitot Tube Purges Dust Safely

Purpose: For measuring air or gas velocity and pressure in dry dust or dirt laden environments.

Features: Blow out system utilizes compressed air to clear total pressure probe and static pressure element of obstructions. Three-way valve prevents direction of blow out pressure toward the gage or manometer. Tube is silver soldered for operation in temperatures up to 800°F.

All tubing and piping is incorporated in a single compact assembly. Careful design eliminates small static openings, pockets or dead end spaces where dust might lodge and resist blow out.

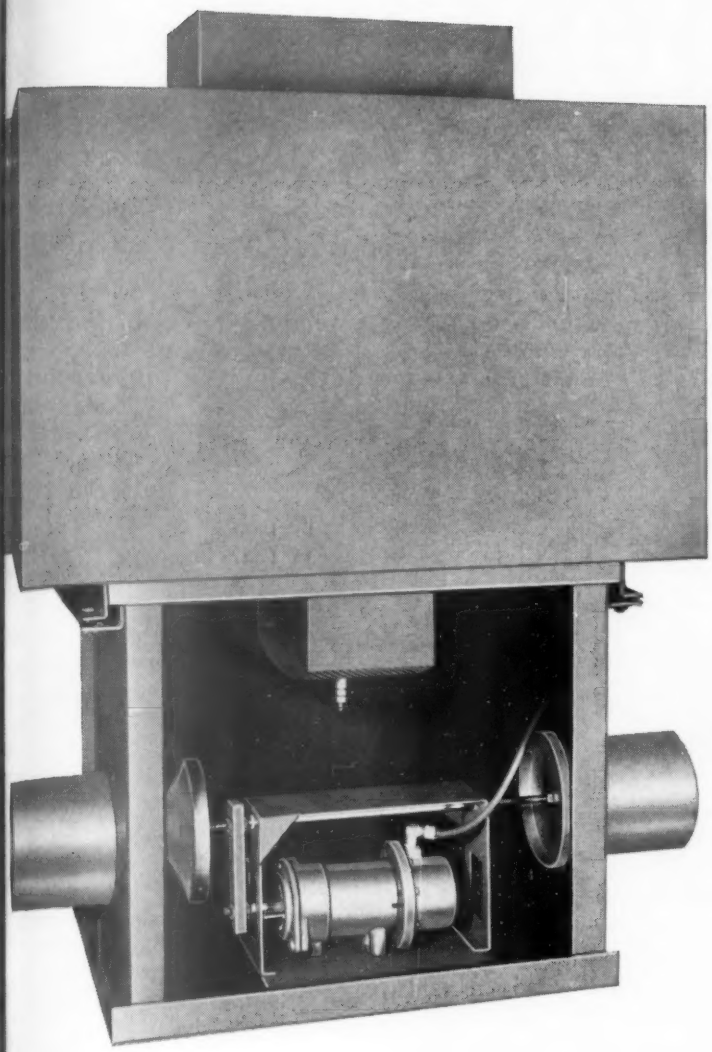
Five tube sizes are available. nominal insertion lengths of three six, 12, 18 and 24 inches are suitable for ducts with six, 12, 24, 36 and 48 inch diameters. Each assembly weighs approximately two pounds.

Source: F. W. Dwyer Mfg. Co. Dept AG-8 (AE), P. O. Box 373 Michigan City, Ind.

(Please turn to page 24)

Use Communications Center, page 51, for requesting more information about articles, advertised products, literature, and for comments about any of the editorial material in this issue of AIR ENGINEERING.

ALL NEW AGITAIR® MIXING BOXES



A MAJOR DEVELOPMENT IN CONSTANT CONTROL AND DISTRIBUTION OF HIGH VELOCITY TEMPERED AIR

A simple design of the all new AGITAIR Type "O" series, high velocity mixing boxes eliminates all troublesome linkages and pivots. Only one motor is employed to operate the inlet valves which are driven directly, guaranteeing instantaneous response with no lost motion or backlash.

The mixing valves proportion the hot and cold air in response to the room thermostat and the unique AGITROL volume regulator guarantees constant control of air delivery at the required volume.

Comprehensive noise attenuation tests were conducted to assure extremely low sound ratings for ceiling and under the window units. And for noiseless, draftless distribution of the conditioned air from these units, there is a complete line of AGITAIR diffusers and grilles from which to choose.

Technical catalog HV-100 contains complete performance data and dimensions on all AGITAIR units. Write for your copy today.

FEATURES

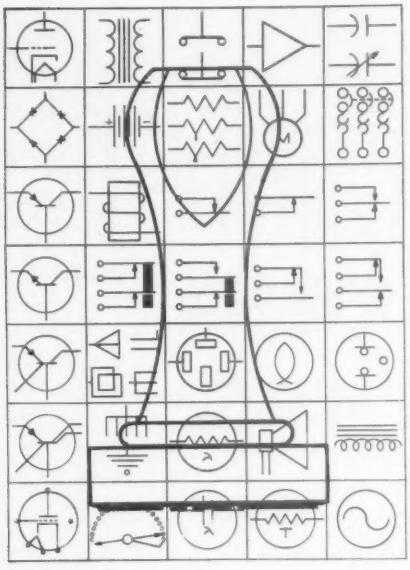
- One motor — no linkages.
- Aluminum inlet valves driven directly — instantaneous response . . . no lost motion . . . no backlash.
- Unique AGITROL valve (constant volume regulator) actuated solely by the supply air.
- Both mixing and attenuation chambers fabricated of galvanized or galvannealed steel . . . sealed to prevent air leakage.
- Split fabrication of attenuation chamber permits dimension adaptation to meet most space limitations.

AIR DEVICES INC.
185 MADISON AVENUE • NEW YORK 16, N. Y.

BETTER PRODUCTS FOR
AIR DISTRIBUTION • AIR CLEANING • AIR EXHAUST

New PRODUCTS

(Continued from page 22)



Technical Rubber Stamps

Purpose: Eliminate tedious detail work, inaccuracy of rough sketching.

Features: All symbols are approximately ¾ in. in diameter. Symbols of construction, heating, ventilating, air conditioning and architectural fields are a few of the available choices.

Source: Paper Equipment Distributing Co., Dept. AE, P. O. Box 90, Prince Street Station, New York 12, N. Y.

Indicating Pneumatic Controllers

Purpose: Control temperature, humidity, pressure, vacuum, liquid level, flow.

Features: Working parts made of stainless steel; diaphragms made of Neoprene. Calibration is simple, as the only condition to be met is that with the measured variable at midpoint on the scale, and with an output of 9 psi, the input and output beams must be level and in line. Two adjustments are provided to accomplish this.

Source: Bristol Co., Dept. AE, Waterbury 20, Conn.

Use Communications Center, page 51, for requesting more information about articles, advertised products, literature, and for comments about any of the editorial material in this issue of AIR ENGINEERING.

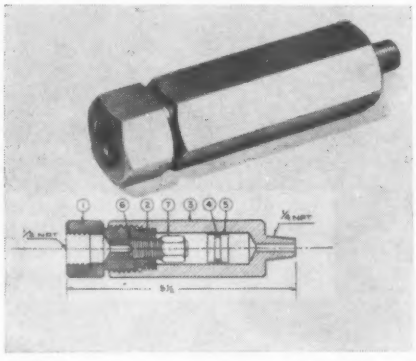
Contaminant Analysis Balance

Purpose: To weigh all sizes of Millipore filters, for gravimetric determination of particulate contamination in air, rocket fuel, hydraulic fluid, and other gases and liquids.

Features: Special stirrups and tares for each size of filter, built-in radioactive ionizing units, increased clearance to accommodate the popular 37 and 47 mm diameter filters, and special instructions for filter weighing.

The instrument gives accurate results under environmental conditions where conventional balances will not work at all, is not affected by temperature, vibration, shock, humidity or level, and can be used by people without any training in chemistry.

Source: Cahn Instrument Co., Dept. AE, 14511 Paramount Blvd., Paramount, Calif.



Flow Check Snubber Protector

Purpose: For protection of plant personnel against the escape of noxious, toxic or flammable liquids or gases in the event of pressure instrument failure.

Features: Isolates instruments from the pressure actuating medium, and assures accurate readings from 100 to 5000 psi. Said to be extremely responsive to small pressure changes within its range, with full equilibrium reached in two to three seconds.

Works equally well with instruments actuated by bourdon tubes or diaphragms. Unique snubber prevents transmission of transient line surges or pulsations. Will not clog or plug, according to manufacturer.

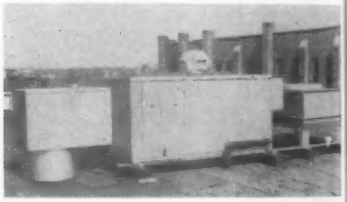
Source: Chemiquip Co., Dept. AE, 36 East 10th St., New York 3, N. Y.

Air Cooled Condensers

Purpose: For all air conditioning and refrigeration applications.

Features: Available from 8 to 8[illegible] tons in single unit. Thirteen Aircoil sizes in horizontal and vertical air flow for multiple unit installations. Automatic head pressure control available as accessories.

Source: McQuay, Inc., Dept. AE, 1600 N. E. Broadway St., Minneapolis 13, Minn.



Roof Heating & Cooling Units

Purpose: To prevent unsightly roof clutter while offering building owners the space-saving economy of roof mounted heating and cooling equipment.

Features: Approximately 18 ft. x 5 ft., units have cooling capacities of eight to 10 tons and heating capacities of 160,000 or 240,000 Btu output. Air conditioning system, filters, blowers, controls and gas-fired heater are housed together.

Cooled by a vertical discharge propeller fan, the condenser which may be mounted next to the main unit, is said to be unaffected by wind velocity. The larger 10 ton unit, including condenser, weighs only 2750 pounds. Access panels for easy servicing. No tools are required to get at components requiring normal servicing.

Source: Typhoon RMU Air Conditioning Division, Hupp Corp., Dept. AE, 505 Carroll St., Brooklyn 15, N. Y.

(Please turn to page 26)

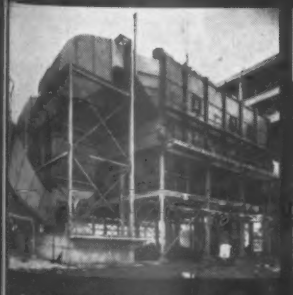
buell
Norblo®

Always your best move for satisfactory dust collection!

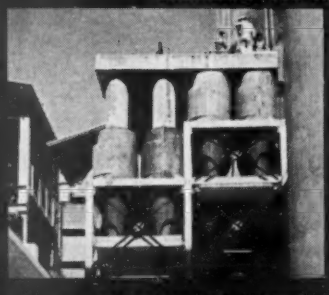
You put more than 75 years of combined experience at your disposal, when you call in a Buell-Norblo sales engineer. He's qualified and ready to help you design and lay out a complete dust collection system with the right equipment for each application. For literature write Buell Engineering Company,
123 William St., New York 38, N. Y.,
Northern Blower Division,
6409 Barberton Ave., Cleveland, Ohio.

ELECTRIC PRECIPITATORS · CYCLONES · BAG COLLECTORS · FANS · COMBINATION SYSTEMS · CLASSIFIERS

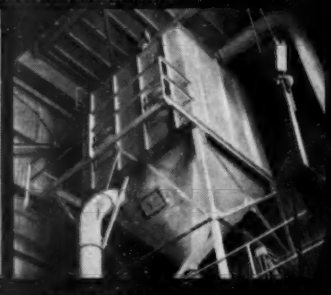
ENGINEERED FOR CONTINUOUS SERVICE



ELECTRIC PRECIPITATORS Excel in high efficiency, lowest maintenance record.



MECHANICAL COLLECTORS "Shave-off" cyclones provide superior performance to ordinary cyclones

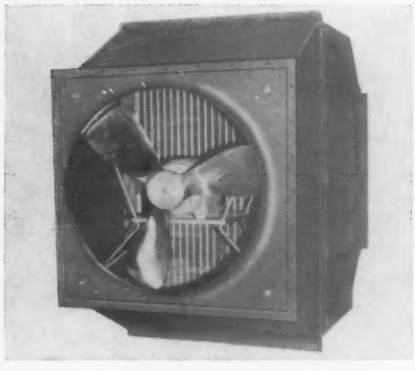


BAG COLLECTORS Automatic cyclic cleaning provides continuous operation at full capacity

CLASSIFIERS Capacity to keep up with any mill . . . low power consumption, no moving parts

New PRODUCTS

(Continued from page 24)



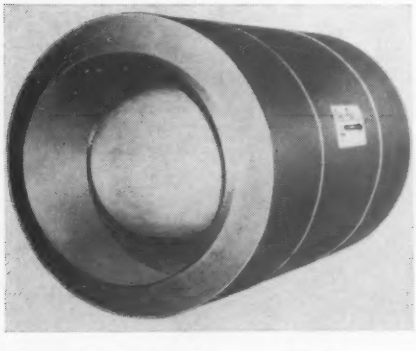
Steam-Fired Make-up Air Units

Purpose: For replacing air removed by operation of exhaust systems.

Features: Four standard units provide a capacity range from 4,000 to 36,000 cfm. (380,000 to 2,642,000 Btu at 5 psi.) Units can be installed without filters and distribution ducts.

Separate accessory control package includes modulating thermostat and steam valve to provide constant discharge air temperature and a pressure-stat to shut down fan and protect against coil freeze up if steam pressures fall below a pre-set point.

Source: Hartzell Propeller Fan Co., Dept. AE, Piqua, Ohio.



New Round Silencer Unit

Purpose: To increase the overall noise reduction, with lower pressure drop, of high pressure ventilating systems.

Features: Silencer makes use of new airflow configuration, offering a "bell-mouth" entrance for minimum entrance loss and a solid nose entrance for maximum noise reflection.

Source: Industrial Acoustics Co., Dept. AE, 341 Jackson Ave., New York 54, N. Y.

Missile Cleaning Facility

Purpose: To meet stringent cleanliness requirements set up by the military and missile prime contractors.

Features: The facility is enclosed in an air-tight three room complex, approximately 1000 square feet, with an airlock entrance. The first room provides space for technicians to change into proper attire; the second provides space for cleaning process, and the third is used for final inspection and packaging of clean parts.

Hose cleaning is done in several steps. A high pressure, high velocity spray is supplemented by a simultaneous vacuum scavenging action in the turbulent spray zone to insure that particles are not redeposited on clean surfaces.

Inspection is performed using Millipore analysis of solutions, black light, visual and other methods outlined in missile manufacture specifications.

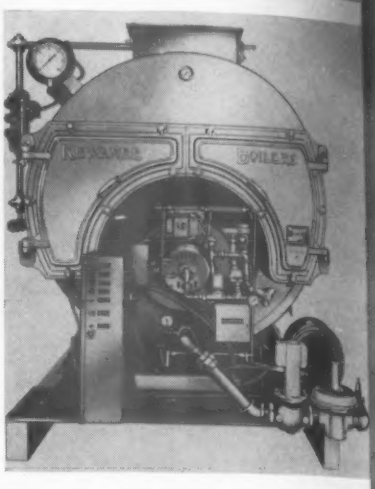
Source: Dunbar-Kapple, Inc., Aircraft Components Division, Dept. AE, Batavia, Ill.

New Electric Unit Heaters

Purpose: Industrial and commercial space heating.

Features: Capacities range from 5 to 25 kw with models available for 208, 240, 277 and 480 volts. Heating element consists of steel fins bonded to steel tubes encasing nichrome wires embedded in magnesium-oxide dielectric. Built-in limit control prevents overheating.

Source: Modine Manufacturing Co., Dept. AE, Racine, Wisc.



Forced-Draft Packaged Boilers

Purpose: Commercial boilers for high and low pressure operation.

Features: Forced-draft firing. Certified output ratings are 83 to 691 hp for low pressure units and 82 to 672 hp for high pressure units. Highest heat release in any of the low pressure packaged units is 66,660 Btu per cu. ft., and in high pressure units, 64,620 Btu per cu. ft.

Source: American-Standard, Industrial Division, Dept. AE, Detroit 32, Mich.

Beryllium Air Monitor

Purpose: Air particulate monitor for the continuous detection of beryllium oxide.

Features: Detection is obtained by the spectographic analysis of material collected on an efficient filter medium. Results given every 60 seconds. Cycling is automatic and adjustable. Alarm device is available and adjustable up to a concentration of 2 ug. of Beryllium per cubic meter of air.

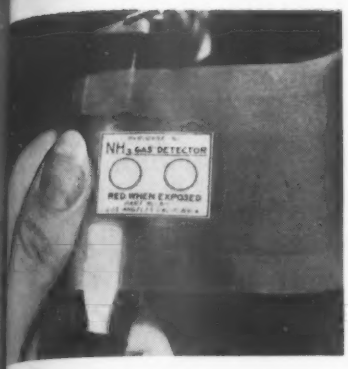
Source: National Spectographic Laboratories, Dept. AE, 6300 Euclid Ave., Cleveland, Ohio.

New Roof Ventilator Models

Purpose: Make-up air and general factory ventilation.

Features: Venturi-type inlet; weather-tight housing; direct-connected drive; permanently lubricated motor; patented, pressure-type, self-cooled motor and motor compartment; low roof silhouette.

Source: Ilg Electric Ventilating Co., Dept. AE, 2850 N. Pulaski Road, Chicago 41, Ill.



e-Tape to Detect Leakage

Purpose: Detect gas and liquid kage of as little as ⅟₁₀₀ cc per ur.

Features: Flexible, adhesive-cked tape bears indicators ich turn a stated contrasting or on exposure to a specific gas liquid. Available for the detec-n of anhydrous ammonia, chlor-e, hydrogen, hydraulic fluids per IL-H-5606, acid fumes and other ses and fluids common to gen-al industrial fields and aircraft, ssile.

Source: Pyrodyne, Inc., Dept. E., 11973 San Vicente Blvd., Los geles 49, Calif.

---

w Cost Insulating Fill

Purpose: For use with low tem-rature liquified gases.

Features: Formed from expand-d silica aggregate, it is said to er maximum thermal resistance minimum cost and safe for jority of cryogenic applications, luding insulating liquid oxygen d liquid hydrogen.

Density, when settled in place, three pounds per sq. ft. Tem-rature limits are from -450°F +1400°F. At -300° it has a rmal conductivity of slightly s than .10 Btu in./sq. ft./°F/ . Available in powder form.

Source: Johns-Manville, Dept. E, 22 East 40th St., New York N. Y.

Use Communications Center, page 51, for requesting more information about articles, advertised products, literature, and for comments about any of the editorial material in this issue of AIR ENGINEERING.

If you wish to contact manufacturers directly, street addresses are given. But please mention you saw it in AIR ENGINEERING.

EQUIPMENT ENGINEERED TO PROVIDE DUST CONTROLLED WORK AREAS

Sterilshield by Baker

"STERILSHIELD" PROTECTION AGAINST MICROSCOPIC DUST PARTICLES

PREFABRICATED DUST CONTROLLED ROOMS

- Workspaces
- Packaged Air Showers
- Prefabricated Clean Rooms
- Dry Boxes
- Vacuum Ovens
- Bearing Handling Tools

Call On Our Experience And Know-How

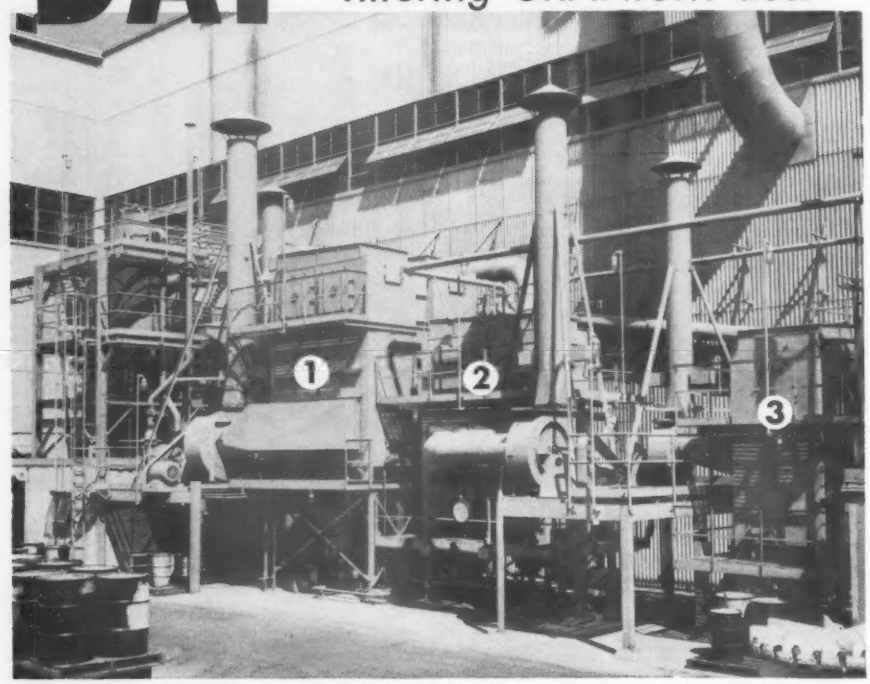
In The East:

THE BAKER COMPANY, INC.
106 Granite Street
Biddeford, Maine

In The West:

BAKER INSTRUMENTS, INC.
P. O. Box 597
Chandler, Arizona

DAY *plant proven dust control filtering URANIUM dust*



3 DAY "AC" Dust Filters Serve MALLINCKRODT CHEMICAL WORKS

URANIUM DIVISION, AEC Weldon Springs Site

Shown above are 3 DAY "AC" dust filters. Filters No. 1 and 2 are collecting magnesium fluoride (M_gF_2) slag dust and U_3O_8 from slag grinding and similar operations. Filter No. 3, on the right, serves to filter uranium tetrafluoride (UF_4).

Equipment with high filtering efficiency is an imperative requirement for an installation of this type. These DAY filters meet this requirement. They capture sub-micron particles with 99.99+% efficiency because they are designed around the Hersey principle of air filtration which uses felted filter media. Filter media porosity is maintained automatically and continuously by high velocity reverse jet air. This assures stable back pressure.

Throughout many industries DAY equipment is preferred because it's *plant proven*. It means DAY not only offers high efficiency and pure, clean air but higher recovery of valuable product. DAY "AC" reverse jet filters are also preferred because they occupy a minimum of space and provide higher air handling capacities (4 to 5 times higher than non-reverse-jet type filters).

For more facts about the services and equipment DAY offers, consult your DAY application engineer, and for complete facts about DAY filters write toDAY for Bulletins F-75 and G-579. They contain helpful planning information and air engineering data.

The **DAY** *Company*

SOLD in UNITED STATES by
The DAY SALES Company
868 Third Avenue N.E.
Minneapolis 13, Minnesota

DAY SINCE 1881

MADE and SOLD in CANADA by
The DAY Company of Canada Limited
Rexdale (Toronto), Ontario, Canada
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Representatives in Principal Cities

EXPERIENCE ENGINEERED . . . LABORATORY TESTED . . . PLANT PROVEN
Dust Control • Pneumatic Conveying • Bulk Storage
EQUIPMENT . . . SYSTEMS . . . INSTALLATION

New Literature

IHF Anniversary Brochure

The Industrial Hygiene Foundation is offering a 16 page Silver Anniversary brochure describing the history and services of this research organization through which many industries cooperate and collaborate on problems of mutual interest.

Among many facets of the IHF touched upon are: information services, toxicological research, publications and memberships.

Source: *Industrial Hygiene Foundation, Mellon Institute, 4400 Fifth Ave., Pittsburgh 13, Pa.*

Fiberglas Capabilities

A Specification Handbook, describing the latest high pressure lamination methods, extending the capabilities of tubular fiberglas components in many fields, is available from Pacific Laminates Inc.

Topics dealt with include: current technical limits, advantages, terminologies, production characteristics and specification outlines for tubular laminated fiberglas components.

Source: *Pacific Laminates Inc., R & D Division, 1919 Placentia Ave., Costa Mesa, Calif.*

Dual Duct Guide

Details for architects and consulting engineers on practical application of dual duct air conditioning along with schematic drawings of typical dual duct arrangements are being offered by Buensod-Stacey Corp., in a bulletin titled "Architects' Guide to Dual Duct Air Conditioning."

The 16-page guide is intended to fill the gap in the availability of literature on dual duct equipment and arrangements presently available.

Source: *Buensod-Stacey Corp., 45 West 18th St., New York, N. Y.*

Sliding Gate & Plate Regulators

An eight-page catalog of sliding gate and plate regulators is available from OPW-Jordan. Included are features, applications, sizing charts, flow curve, sample specifications and complete engineering information.

Source: *OPW - Jordan, 6013 Wiehe Rd., Cincinnati 13, Ohio.*

nual P.M.&E. Report

The 11th volume of the annual ries, "Techniques of Plant Main- nance & Engineering—1960," is w available. The 341 page book a report of the P.M.&E. Confer- ce held earlier this year in Phila- lphia.

Reprinted are the 34 papers pre- ted at the conference, text of discussions, comments, questions d answers. Nearly 2,000 prob- ms are analyzed, with corrective lutions suggested. Ninety-seven bles, charts, graphs and dia- rams are reproduced. Price: $10.

Source: *Clapp & Poliak, Inc., 11 Madison Ave., New York 17, N. Y.*

Tips For Plastics Welders

"Making Better Plastic Welds" is an 11 chapter practical instruc- ion book intended as an aid in the training of both presently ac- ive and new plastic welders. Theory and history are minimized with concentration upon practical nformation, procedures and "tricks of the trade." Over 100 illustra- ions. Price: $1.

Source: *Laramy Products Co., Beechwood St., Route 3A, Cohas- et, Mass.*

Ventilating Set Catalog

A complete line of direct and v-belt driven ventilating sets is dis- cussed in a catalog available from the Sturtevant Division of West- inghouse Electric Corporation.

Complete engineering data for models with volumes up to 21,500 cfm and static pressures to 2½ n. of water are listed. The per- formance data for v-belt driven models features two motor and v-belt drive selections to cover a broader performance range.

Source: *Westinghouse Electric Corporation, Sturtevant Division, 142 Hyde Park, Boston 36, Mass. Catalog 1160.*

York Equipment Brochure

A four-page brochure is offered by the Otto H. York Co., giving information about design, construc- ion services, and equipment, as well as descriptions and applica- ions of separator vessels for steam, air, gas and vapor phase chemicals.

Source: *York Process Equipment Corp., 4 Central Ave., West Orange 4, New Jersey.*

A new development in air dynamics!

A NEW FAN. Today's airfoil centrifugal fan performance in a new space-saving shape. Uses less than half the installed space of conventional centrifugal fans. Interested? Watch for an October announcement.

Our new space-saving centrifugal fan and catalog will be available in October. Why not write now and reserve a copy of the catalog? You can be sure if it's Westinghouse. Sturtevant Division, Hyde Park 36, Massachusetts.

Westinghouse

Over 37-acres of varied usage floor space create many problems in..

Fig. 1: *Model of photo of Cobo Hall. Arrows point to main areas:* 1: *Entrance;* 2: *Convention Arena, 315 ft. diameter and 120 ft. high;* 3: *Dining Area seating 2800 people;* 4: *Six-lane expressway running under Cobo Hall;* 5: *Roof-top parking for 1200 cars on 12-acres of roof;* 6: *Under roof is exhibit area totalling 300,000 sq. ft.;* 7: *Under first floor exhibit area is another exhibit area of 100,000 sq .ft.;* 8: *Main concourse off entrance, serving as passage to exhibit areas, dining areas and offices.*

Heating and Cooling The World's Largest Convention Hall

Detroit's new Cobo Hall exhibition and convention building has an air conditioning system big enough to handle 30,000 people, with tough air distribution and ventilation problems.

by Lester Maurer*
Mechanical Engineer
Giffels and Rossetti,
Architects and Engineers

THE WORLD'S LARGEST EXHIBITION and convention hall will be opened this Fall in Detroit. The varied occupancy and usage of spaces within Cobo Hall posed many tough problems of air conditioning and ventilation, not the least of which was a six-lane highly travelled expressway which runs through the lower level of the structure.

Two large central exhibit areas, one of which can be divided into three separate halls by partitions, the many meeting rooms, eating areas, kitchens, TV studios and their control rooms, and press rooms, all demand different engineered air conditions.

This $45-million dollar structure is the largest in the Detroit Civic Center Development, and is comprised of three basic components . . . Cobo Hall proper, a four-story exhibit building about 500 ft. x 715 ft.; the Meeting and Banquet section, three stories

**Lester Maurer, mechanical engineer, has been employed for the past 15 years by the firm of Giffels & Rossetti, Inc. He has had major experience in the design of heating, ventilating and air conditioning systems for industrial and institutional buildings, together with design and development of contaminated air handling and air filtration systems for nuclear facilities operated by the Atomic Energy Commission. He is in charge of the design and coordination of all mechanical facilities for the Cobo Hall project.*

nt 500 ft. x 150 ft. and the Convention Arena, a ular building 315 ft. in diameter and 120 ft. high. e entire building is air conditioned with the excep- of storage spaces and parking garages.

The main floor of Cobo Hall is chiefly exhibit ce. This floor has three interconnecting halls, B & C, each with a floor area of 100,000 sq. ft., a 30 ft. ceiling height, which can also be used one large hall by opening the dividing partitions, viding an open area equal to 6 football fields. e chief purpose of the exhibit halls, as well as D, another 100,000 sq. ft. hall on the ground floor the building, is to provide booth space with vice facilities for exhibitors at the shows conducted numerous national societies such as the Society of tomotive Engineers, the American Foundrymen's ciety, etc.

Exhibit booths may be erected in numerous sizes arranged in various patterns to advantageously splay the manufacturers' product. Each of these ooths may require services such as light, power, mpressed air, gas, water, drain or steam, as well as dequate ventilation, particularly for heat producing quipment. Conceivably, these large areas could also e used as a place for assembling a large audience.

The air conditioning system has been designed to andle a crowd of 30,000 people. Around the perimeter the large halls are many various sized meeting ooms on two floors. All of these meeting rooms equire individual room air conditioning control. Add this the requirements for exhibitors' storage, a arking garage for 600 cars in the building, plus 200 cars on the 10-acre roof of the building, and a lane expressway running through the building at he lower level, and you get some idea of the air ngineering problems facing the designers.

The Meeting and Banquet section contains numer- us meeting rooms together with the main dining acilities of the building such as: a coffee shop, a cafeteria which seats 1,500 people and a banquet hall which accommodates 2,800 people. The kitchens serving these rooms are enormous and present quite a ventilation challenge. The banquet room and cafeteria are built out above the roadway running along the Detroit river so the patrons can figuratively reach out and touch sea-going ships as they pass by. Although this massive glass wall has heat absorbing glass, the south exposure poses a problem for air conditioning.

The Convention Arena is a multiple tiered circular arena with 10,000 permanent seats and 3,200 temporary seats, to be used for conventions, sports or shows. Brine piping embedded in the concrete will convert the floor into an ice rink for hockey, ice shows or public skating. Television studios, with their associated control rooms, and press correspondents' facilities add to the woes of the air conditioning engineer. Adjoining the Arena is a 400 car underground parking garage.

Air Systems

The air distribution systems are basically medium velocity (2,000 fpm) and low pressure (2 in. s.p.). Larger fan systems are a built-up assembly of fan, heating and cooling coils and filter. Smaller systems consist of package-type multizone or single zone units. Air filters are electronic-type with a semi-automatic wash cycle. Steam at 30 psi is supplied to preheat and reheat coils. Chilled water is distributed from the central refrigeration plant to the cooling coils. Throughout most of the building, supply air is introduced into the occupied spaces through ceiling diffusers. Some of these are supply and return type. The prime exception to this is in hall D, which is supplied by double deflection grilles near the top of the columns.

The total conditioned supply air volume is 1,750,000 cfm and the total capacity of all fans, supply, return and exhaust is 4,550,000 cfm. It took 700 tons of sheet metal to fabricate the ducts to convey this

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Fig. 2: *Main concourse on Convention Arena side of Cobo Hall. This view is looking toward south end of lobby. Note air outlets in ceiling, wall-fin radiation under lobby windows.*

Fig. 3: *Banquet hall in Cobo Hall has capacity to seat 2800 guests. Hall can be divided into sections by movable partition shown at left of photo. This room faces south, looks out over Detroit River toward Windsor, Ont., Canada. South exposure creates cooling problems.*

Fig. 4: *Exhibit Hall D, with 100,000 sq. ft. of floor space. At left, workman is balancing air delivery system. Air is delivered through grilles in columns, and exhausted through registers in walls at right. Both supply and exhaust ducts run under floor to fan room adjacent to hall.*

(Continued from preceding page)

air and requires 2,200 motor horsepower to drive the fans.

Storage areas are heated and ventilated, using air circulating systems. Truck docks and isolated areas are heated with unit heaters.

Cobo Hall System

In Cobo Hall, corridors extend around most of the building perimeter. This permits the variable outside load to be absorbed by the corridor systems. Perimeter radiation makes up for about 50 percent of the wall heat loss. Opening onto these corridors are the many meeting rooms, which are interior rooms as are also the large exhibit halls. By eliminating the outside wall loads, these rooms can be held to a closer temperature tolerance than rooms with an outside exposure.

Large meeting rooms are supplied by a single air handling unit. Smaller meeting rooms are supplied as individual zones on a multi-zone system or are served by a double duct system. All meeting rooms are individually controlled. Corridors are served by separate systems, which permits all public areas to be conditioned, even when the halls and meeting rooms are not in use.

Exhibit halls A, B and C, with a 30 ft. ceiling height on the main floor of the building, are supplied by diffusers worked into the pattern of the ceiling. Each of the three halls is supplied by four supply systems, each serving one quarter of the hall.

Aside from keeping the equipment within practical limits of size, this arrangement permits the system to compensate for localized heat loads. Return air from these halls is collected by grilles located 10 ft. above the floor along the east and west walls. Supply and return ducts are lined with acoustical material which also serves as thermal insulation.

To overcome the possibility of insufficient air circulation at the center of the halls and excessive circulation at the side walls, some exhaust air is taken through the ceiling into the truss space above, and thence to the fan rooms which run the full length of the building along the east and west walls beneath the roof. This helps to remove some of the solar heat and conduction transmitted through the eight acres of black surface parking roof before it reaches the exhibit halls below.

Architectural treatment permitted the installation of continuous louvers along the east and west wall face just below the roof for supply and exhaust. It is anticipated that some shows will have exhibitors displaying equipment, such as gas heating equipment, furnaces, etc., which will release considerable heat. This type of operation would put an undue load on the air conditioning system and possibly add noxious fumes. In order to exhaust this heat or fumes directly to outdoors, an exhaust header was installed above the ceiling along the east and west walls of the halls, with a capped connection every 60 ft. A temporary duct can be run from a hood over the equipment on display to the exhaust header simply by removing a ceiling panel. When a show is laid out, the heat generating displays can be located along the east and west walls.

Hall D on the ground floor of the building has columns on 60 ft. centers. At the head of each column just below the 19 ft. ceiling are air supply grilles discharging in four directions. These grilles are fed from the air handling equipment located nearby, through an underfloor air tunnel system consisting of a header with branches which connect to a plenum box at the base of each column. The annular space between the structural column and the outer steel decorative shell serves as an air plenum between the column base and the grille at the ceiling. Return air is collected in another underfloor tunnel, paralleling the supply tunnel, through grilles 10 ft. above the floor spaced across the south wall of the hall.

The only large expanse of exterior glass in spaces other than corridors occurs in the Cafeteria and the Banquet Hall with a long south wall and short east wall. This is heat absorbing glass to reduce the solar load about 30 percent. Each of these rooms has its own air handling system which will respond to the load variations. Makeup air for the kitchen systems is taken from the serving area return air.

Convention Arena System

Corridors and ramps extend around the perimeter of the building, permitting perimeter radiation to make up about 50 percent of the wall heat loss. Three equipment rooms spaced around the perimeter of the building at the ground floor level contain the air supply units which serve the arena and also the areas beneath the seats. The upper tiers are supplied by ceiling diffusers while the lower tiers and the Arena floor are supplied by grilles 6 in. wide by 15 ft. long mounted in the top of the tier fascia railing. Return air is drawn through grilles in the risers of the seating tiers and discharged into the corridors by fans in the plenum spaces beneath the seats.

From the corridors the air either returns to the supply systems and is recirculated, or it is discharged to outdoors by exhaust fans located in the truss area above the Arena ceiling. The checkrooms, lockers and storage spaces under the Arena seats are served by conventional supply and return systems.

Automatic Control System

The automatic temperature control system is a combination of electronic sensing and transmission with pneumatic actuation. In multizone and double duct systems, the room thermostat modulates the mixing dampers. Hot and cold deck thermostats control the valves on heating and cooling coils. In single zone systems, the room thermostat or return air thermostat modulates the valve on the heating coil and cooling coil in sequence. Preheaters have face and by-pass dampers controlled by the mixed air temperature.

Since Cobo Hall and the Convention Arena are completely air conditioned, the most practical method of operating the two buildings is to provide centralized control of practically all mechanical services and most of the electrical services. The mechanical and electrical items not controlled from the panel are monitored to provide indication of malfunctioning. The heart of this tremendous control system is the electronic central control panel 10 ft. high and approxi-

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Fig. 5: *Ramp leading to roof top parking on Cobo Hall has snow-melting system which is almost mandatory due to the fairly steep [illegible] of the drive and the curves involved (see Fig. 1, drive ramp approach to rooftop at left of photo, or same area on lower right of front cover). Traffic moves up and down ramp as fast as curve will allow and any accumulation of snow could result in serious accident or lengthy traffic tie-up.*

Fig. 6: *Another view of Lower Convention Hall D, showing supply air grilles in columns, at right, and return air grilles at left in the wall. Supply duct to grilles in columns and return duct from grilles in walls, runs through ductwork located underneath floor.*

(Continued from preceding page)

mately 72 ft. long. It requires a room 36 ft. wide and 40 ft. long to house the U-shaped control panel and the control console. Approximately 20 miles of electrical wiring is needed in the buildings and on the control panel to provide the operation and monitoring of the equipment in the building. To operate the panel, two engineers are required, one electrical and one mechanical.

The control console contains the public address system, building code call system, watchman's supervisory switchboard and the fire alarm monitoring system. Over the public address system, announcements can be made either throughout the building or in specific locations, and music can be provided throughout the building using tape, records or radio. Actuation of any fire detecting element in the building will automatically call the fire department and indicate, on the console, the location of the fire.

The electrical portion of the panel provides monitoring of all power transformers, control of lighting throughout the buildings, and control and monitoring of the electrical snow melting system.

The mechanical portion of the panel is comprised of a graphic section and a control section.

The graphic section of the panel shows the building outline and room locations. It provides an indication of the operation of 46 air supply systems and 34 garage exhaust fans. The temperature in 133 rooms and areas can be checked on a temperature indicator by pushbutton. The temperature in the Exhibit Halls, Banquet Room, Cafeteria and the larger meeting rooms can be adjusted from the panel. If, in checking room temperatures, the engineer discovers that a room is too hot or cold, he can reset the temperature in that room from the control panel, without going to the room which may be located three blocks from the control room.

The control section of the panel provides control and monitoring of the 189 supply, return and exhaust fans required to air condition and ventilate the building. Temperature check points built into each supply system can be used to monitor system operation from

Fig. 7: *Garage in Cobo Hall has space for 600 cars. Another underground two-level garage adjacent to Convention Arena accommodates 400 cars. Both garages require mechanical ventilation at the rate of 5,000 cfm moving car.*

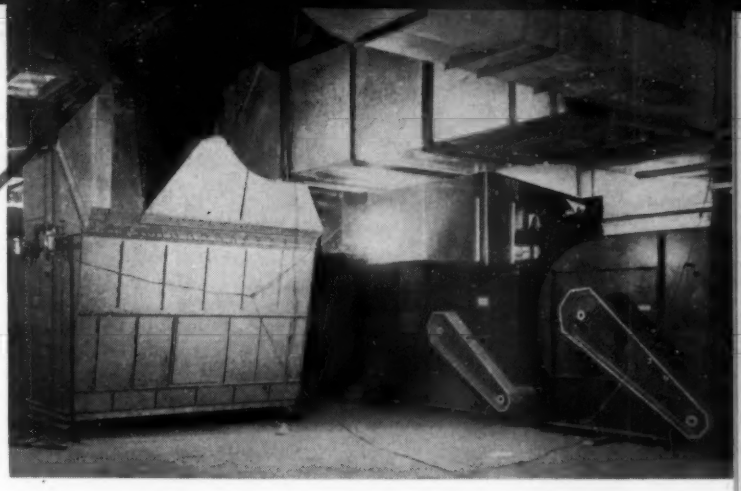

Fig. 8: *Typical multi-zone system and return air fans. Photo was taken during construction, hence the cluttered look.*

control panel. Operating time of each of the banks of electronic air filters used to clean the 50,000 cfm of supply air the building requires is dicated on the panel This will be a guide for r maintenance.

Dampers in each air supply unit are adjustable om the panel to provide any desired percentage of tside air from zero to 100 percent, selected by the gineer, as determined by space occupancy and tside temperature. Should a record of the tempera- re in any of the 96 selected areas be desired for day, a week, or longer, the engineer can plug into recorder on the panel any 12 points desired. The pumps required for domestic water, chilled water, ndenser water, etc. can be started and stopped d have their operation monitored at this panel.

The carbon monoxide level in both garages and the expressway tunnel under Cobo Hall is con- uously recorded and this recorder-controller oper- es the garage ventilating fans. The operator also s the option of turning on these fans from the ntrol board by manipulating an auto-manual se- tor switch.

efrigeration System

The total connected load on the refrigeration plant 6,900 tons. After applying diversity factors for ccupancy and exposure this reduces to a design load 5,120 tons. There was much deliberation over the pe and size of equipment to be used for this central lant. Heating steam is provided from the Detroit Edison Company district steam system. Electric power mes from the Public Lighting Commission service. Consideration was given to absorption refrigeration, t in the final analysis, motor-driven centrifugal achines were selected on the basis of greatest econ- y. Synchronous drive at 4,800 volts was requested the Public Lighting Commission.

The machines installed are four 1,250 hp syn- hronous motor driven centrifugal machines each of hich delivers 1,280 tons of refrigeration, cooling 560 gpm of water from 54F to 42F, when supplied ith 2,500 gpm of condenser water at 77F. These achines have automatic capacity control to adjust variable loads. A pumpout compressor and receiver ill remove the Refrigerant-12 from any machine hen servicing is required.

Four chilled water pumps will circulate a maximum of 10,240 gpm through the chilled water system with pipes sized from 24 in. headers on down the scale. The pump discharge piping is manifolded so that any pump can be operated with any refrigeration machine. Throttling control valves on the cooling coils of the air handling units permit a minimum number of pumps to operate at light loads.

The location of the building on the river bank, together with space and esthetic considerations preclude the use of a cooling tower. Condenser cooling water is taken directly from the river through an intake 10 ft. below the surface, conducted to the building by a concrete flume and screened before entering the pump well. Sodium hypochlorite is injected into the water in the wet well to inhibit algae growth in the condensers and piping system. Cooling water pumps, vertical submerged type, discharge into a common manifold so that any pump can be operated with any refrigeration machine. After passing through the condenser, the water is returned to the river through a flume beside the intake flume and discharged downstream of the intake.

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Fig. 9: *Machinery room, showing the four 1,250 hp synchronous motor driven refrigeration compressors, each of which delivers 1,280 tons of refrigeration, cooling 2,560 gpm of water from 54°F to 42° when supplied with 2,500 gpm of condenser water at 77°.*

(Continued from preceding page)

Exhibit Services

In order to provide adequate facilities to exhibitors who wish to display operating equipment it was necessary to determine the requirements of all national organizations who would be potential exhibitors. It was determined that compressor air, gas, water and drain should be available to the display booths with a minimum of temporary piping required. The fact that there are only 10 columns in the 300,000 sq. ft. of exhibit floor area of halls A, B & C ruled out the customary method of furnishing services at the columns.

A divided cast iron box with a removable cover plate was designed to set in the floor and be piped up from mains below. These boxes, with valved connections accessible from the floor, are placed in a modular pattern in both directions throughout the exhibit area. Exhibit booths may be laid out with the back wall of the booth along a row of boxes. Then the covers may be removed and the desired services connected by temporary piping. Although steam service to the building is 30 psi, some exhibitors may require 100 psi steam. High pressure steam outlets are located along the west wall of the halls, terminating in valved connections in wall boxes 10 ft. above the floor. The high pressure steam system has its origin at the truck dock where a portable steam generator can be hooked-up to provide the pressure and volume required.

Hall D, with columns on 60 ft. centers, has been provided with air and water service in each column as well as in floor boxes placed in a pattern in the top of the under-floor air tunnels. The building compressed air system will be adequate for normal demands. If a heavy demand is encountered the building system can be supplemented with portable air compressors located on the truck dock, and piped temporarily to a connection provided for this purpose. The piping system has been adequately sized for a heavy demand.

Garage Ventilation

Indoor parking facilities for the project are provided by a two-level garage in Cobo Hall which accommodates 600 cars, and an underground two-level garage adjacent to the Convention-Arena, which accommodates 400 cars. Being completely enclosed, both of these garages require mechanical ventilation. The six lane expressway which runs beneath the building abuts the south wall of the Cobo Hall garage and the north wall of the Arena garage. This forms a tunnel 800 ft. long which, under normal conditions, is self ventilating, but which would require mechanical ventilation if for some reason the traffic were stalled.

The ventilation requirements of the parking garages and the expressway tunnel were established by the Detroit Department of Health, Bureau of Industrial Hygiene. During times of maximum activity in the garages it was estimated that one car in ten would be in operation and that each moving car would require 5,000 cfm of ventilating air. This adds up to moving 300,000 cfm through the Cobo Hall gage and 200,000 cfm through the Arena garage. This was accomplished by using propeller-type fans mounted in the wall of each garage common to the expressway and exhausting the garage air into the expressway. Twenty fans at 15,000 cfm, 10 in each level, spaced across the entire wall length, serve Cobo Hall garage. Air enters from the street through openings across the north wall 8 ft. above the sidewalk. The Arena garage is exhausted by 14 fans, 7 in each level, located across the north wall and discharging into the expressway. Air is supplied through grilles spaced across the south wall.

The operation of these ventilating fans is controlled by two carbon monoxide analyzers. Two sampling ports are located on each level in each garage and two in the expressway. Two fans on each level will operate when the garage is in use. When the level of carbon monoxide reaches 75 parts per million half the fans are put into operation and when the level reaches 100 ppm, the remaining fans are turned on. When the level of carbon monoxide reaches 100 ppm in the expressway, the exhaust fans in the Cobo Hall garage are turned on to purge out the tunnel.

Fire Protection

Although the building has been constructed as fire resistant as possible, all areas are protected by sprinklers and/or a standpipe system of hose racks. The unheated parking garages and the expressway tunnel have dry pipe systems. Connections into two city water mains together with hydrants and fire department siamese connections around the building perimeter insure an unfailing water supply. The siamese on the south face of the building can be pressurized from the fireboat. A 1,500 gpm fire pump will maintain pressure and flow on demand. Flow alarms and manual pull boxes are wired directly to fire department headquarters and also to the console in the central control room. All supervisory controls such as water and air pressure and valve position indication are wired to the console. Kitchen hoods are provided with steam for extinguishing grease fires.

Thus Cobo Hall, the country's newest and largest exhibition hall, has a mechanical system equipped to

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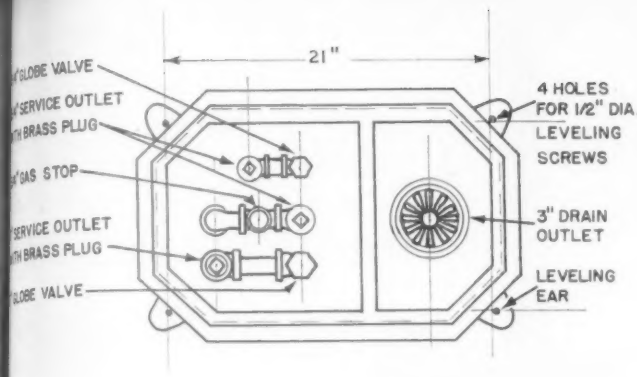


Fig. 10: *Floor service box for mechanical services. These boxes were necessary because there are only 10 columns in the 300,000 sq. ft. of exhibit area, to get steam, compressed air, water, gas and drain to each exhibit area.*

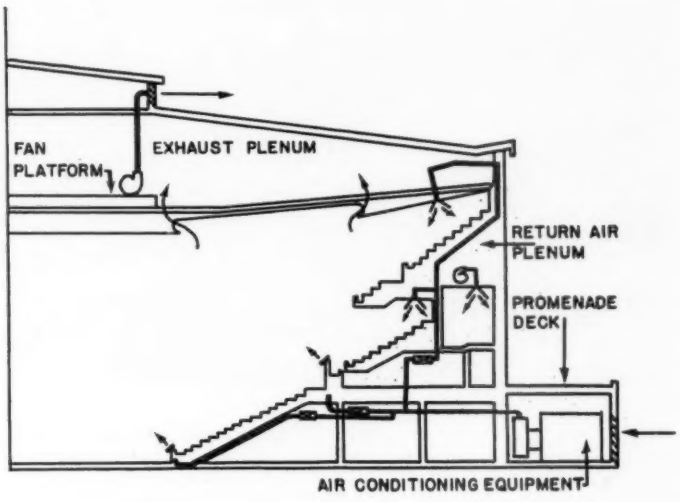


Fig. 11: *Half section of Convention Arena, showing air distribution pattern.*

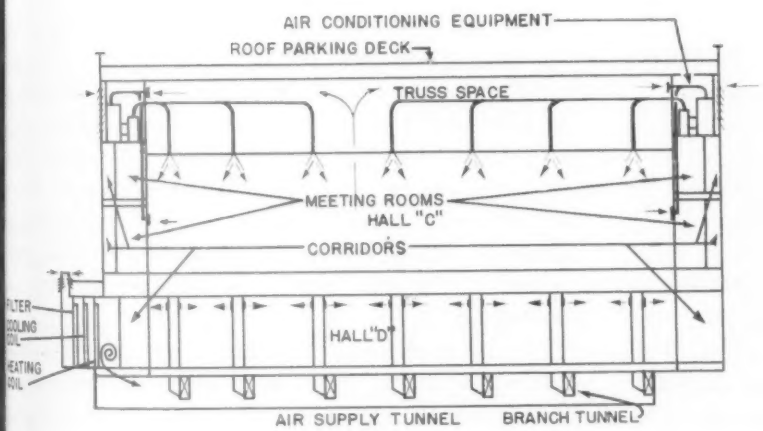


Fig. 12: *Section through Cobo Hall, showing air distribution pattern for Halls C and D.*

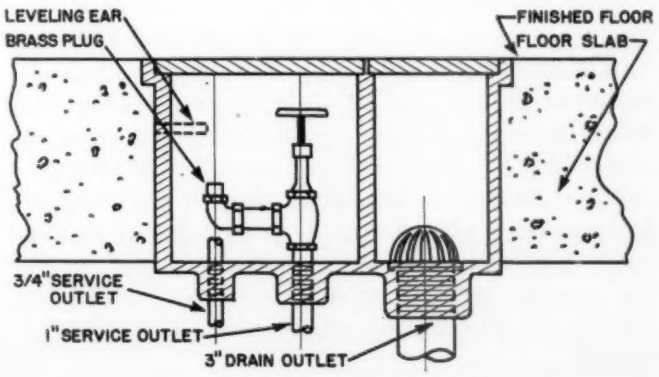
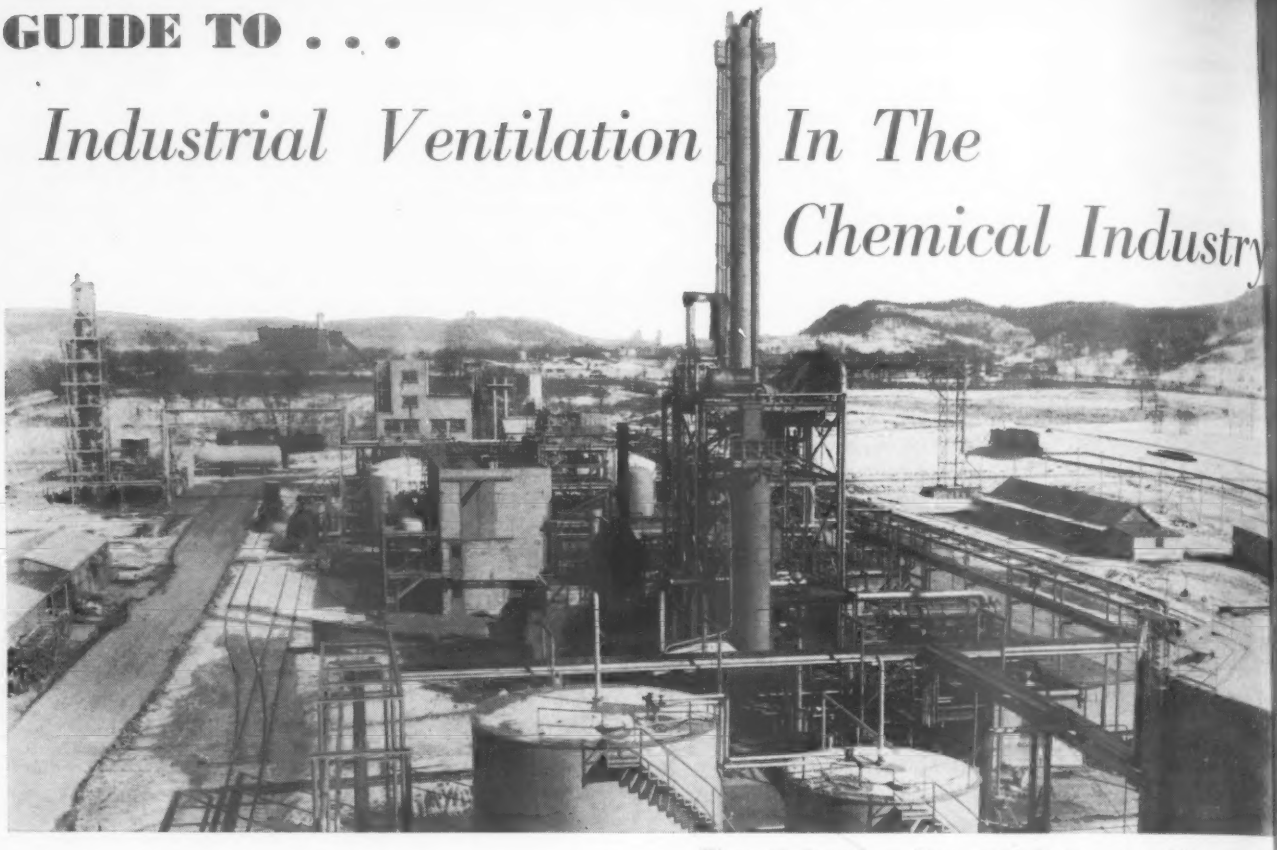


Fig. 13: *Section through the exhibit floor service box shown in Fig. 10 at top of this page. These boxes were specially designed for Cobo Hall exhibit areas, and make it easy to get all necessary services to exhibit areas without stringing unsightly piping and cluttering up floors with hose, etc.*

GUIDE TO . . .

Industrial Ventilation In The Chemical Industry



View of American Cyanamid Co.'s new aniline manufacturing facilities at Willow Island, W. Va. Plants such as these require careful design of ventilating systems to maintain employee health.

By William V. Andresen
Chief Industrial Hygienist
American Cyanamid Co.

If your plant processes liquid chemicals, you will find this data on ventilation of filling operations of value. Includes batch or continuous filling.

LIQUID CHEMICALS MADE BY BATCH or continuous process are packaged in various size shipping containers. Many of the filling operations are performed manually and the operator may be exposed to toxic or irritating concentrations of gases, vapors or mists that are evolved during the operation unless some type of control is employed.

The containers that are used range from small bottles, cans and pails to carboys and large drums.

The gases, vapors and mists liberated during small container filling can be controlled by performing the filling operation within a booth type enclosure as is shown in Fig. 1. The container, as well as the fillpipe valve, is located within the enclosure. Capping or covering the container may be performed within the hood. This type of hood is usually relatively small and may be installed on a table top. A hood face velocity of 100 fpm will usually provide satisfactory control.

Leakage from the filling equipment or accidental spills will be contained within the booth type hood by sloping the base of the hood slightly inward.

Slot type ventilation may also be used for this type of operation where one container is filled and closed at a time. The filling and closing operations should be performed as close to the hood as possible. Usually an air volume of 100-150 cfm will provide satisfactory control. Fig. 4 shows slot ventilation for large containers. A similar system would be used for small containers.

Small container liquid filling operations are often performed on a production line basis where more than one container is filled and/or covered at a time. Slot type ventilation may be used to provide the desired control as is shown in Fig. 2. The slot should be so located that the filling and closing operations are as close to it as possible. Fig. 2 shows two slot

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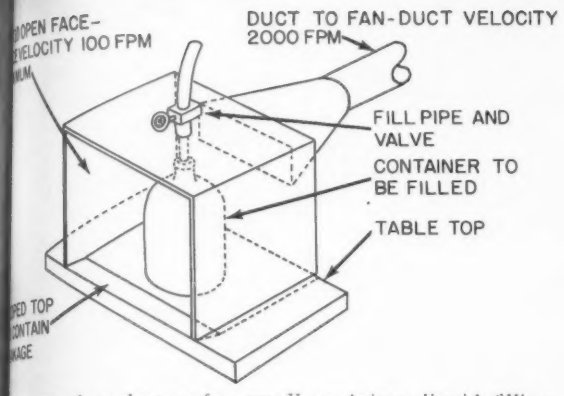

Fig. 1: *Hood enclosure for small container liquid filling operations.*

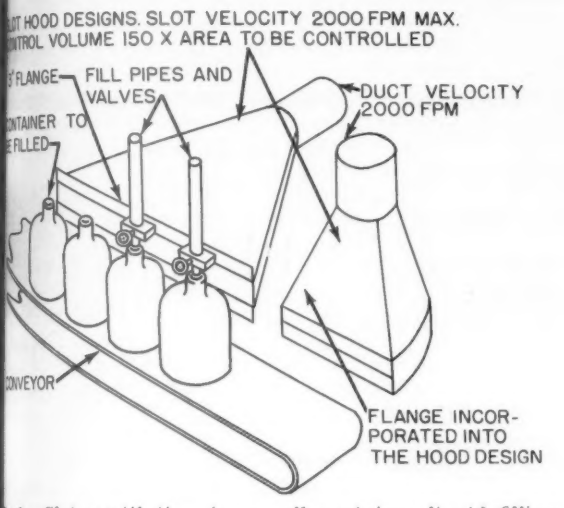

Fig. 2: *Slot ventilation for small container liquid filling operations on a production line.*

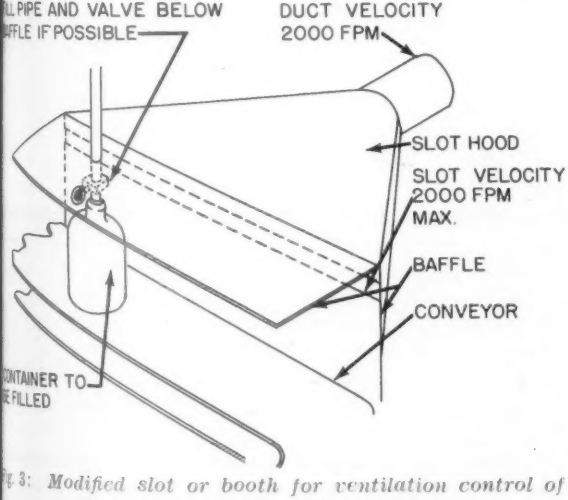

Fig. 3: *Modified slot or booth for ventilation control of small container liquid filling operations.*

hood designs which may be used for control.

This type of ventilation will be affected by cross drafts. Leakage from the fill pipes and accidental spills will not be contained within the hood and may be a problem or a health hazard.

The slot ventilation design may, however, be modified by the installation of baffles as shown in Fig. 3 to form a semi-booth enclosure.

The ends are left open to allow the entry and exit of the containers. This design will be less affected by cross drafts and leakage from the fill pipes and accidental spills will be contained better. However, the work area for the operator will be limited somewhat.

The filling of carboys or large drums may be performed at a fixed location. Filling may be done either on a volumetric or on a weight basis. Control of the vapors, gases or mists liberated from carboys or drums that are filled through a small bung, during filling operations may be accomplished by slot hood ventilation as shown in Fig. 4. The filling pipe is usually located in a fixed position. The hood ductwork may be made of a slip fit design so that the hood may be raised or lowered to provide control of containers of different height. A roller conveyor may be provided for ease of container handling.

A flexible filtering line is often used to fill bunged drums and carboys either at a fixed location or when several containers are filed up next to each other and filled by moving the line from one to another. A slot hood attached directly to the fill line as shown in Fig. 5 may be used to provide the desired control. Control can also be realized by the duct itself without a hood or by a canopy hood as long as the hood is positioned close to the opening where the vapors are liberated. In practice, it has been found that a volume of 100-150 cfm will provide satisfactory control.

Control of carboy and bunged drum filling operations may also be realized by the use of a booth type enclosure similar in design to the one shown in Fig. 1 for small container filling. The booth may be designed to accommodate a scale and roller conveyor if desired. A considerably larger volume of air will be required for control with the hood enclosure than with the slot hood which can be located close to the source of contaminant liberation.

Open top metal or fiber drums are also used as shipping containers for liquids. If the drum filling operation is performed at a fixed location, a modified booth enclosure similar to the one shown in Fig. 6 has been found to provide excellent control. The hood should be of a design large enough to permit the drum cover to be put in place under controlled conditions. A roller conveyor may be used in conjunction with the hood for ease of drum removal.

Many liquid drumming operations are often performed using a flexible filling hose. The drums are set side by side and the filling hose moved from drum to drum. A portable hood as shown in Fig. 7 may be used to provide control of vapors liberated during drumming operations. The hood should be fabricated

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of aluminum or plastic for lightness and ease of handling. A handle may be provided for moving the hood from drum to drum. The cover of the drum may be put into position at the same time the hood is moved so that control of the covering operation may be realized.

A mechanical exhaust fan of either centrifugal or axial flow design is generally used to provide the air volume required for control in the hood designs described. Air ejectors have been used to provide the air volume required for slot ventilation for carboys when extremely corrosive materials are handled. ▲▲

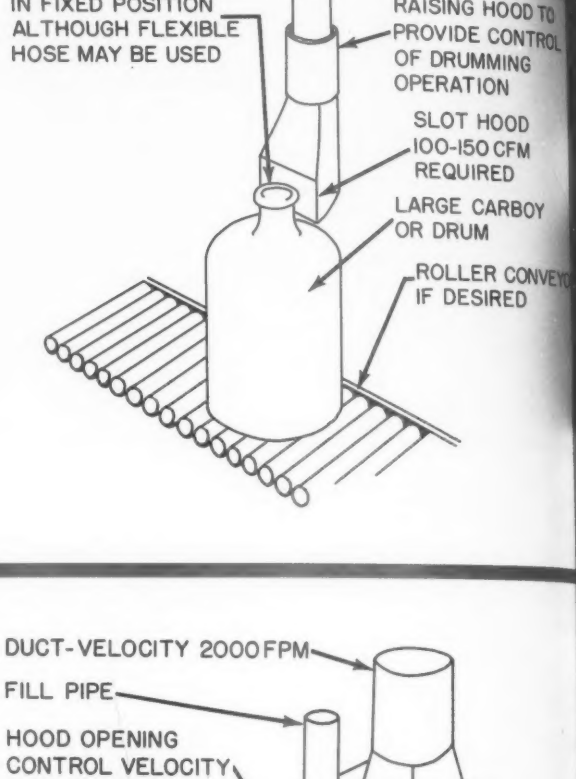
FILL PIPE SHOULD BE IN FIXED POSITION ALTHOUGH FLEXIBLE HOSE MAY BE USED
SLIP FIT TO ALLOW RAISING HOOD TO PROVIDE CONTROL OF DRUMMING OPERATION
SLOT HOOD 100-150 CFM REQUIRED
LARGE CARBOY OR DRUM
ROLLER CONVEYOR IF DESIRED

Fig 4: *Slot hood for carboy filling.*

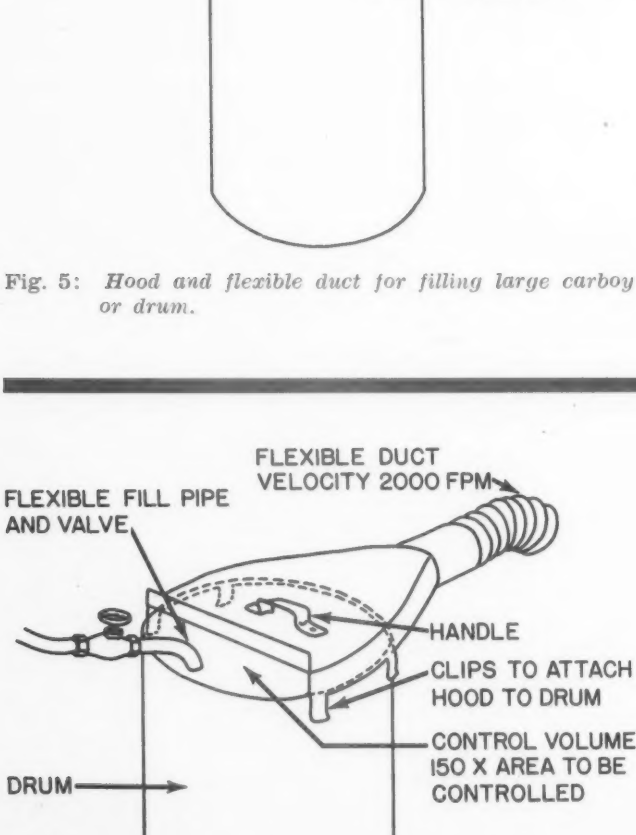

Fig. 5: *Hood and flexible duct for filling large carboy or drum.*

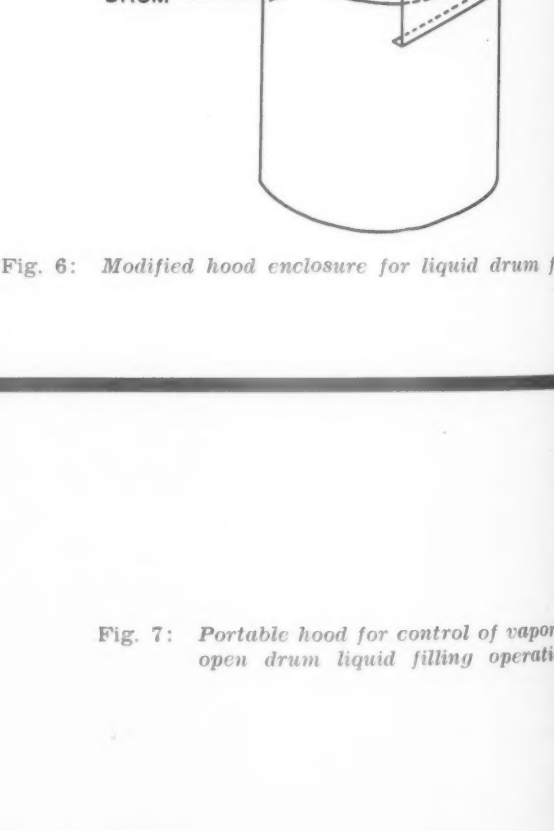

Fig. 6: *Modified hood enclosure for liquid drum filling*

FLEXIBLE DUCT VELOCITY 2000 FPM
FLEXIBLE FILL PIPE AND VALVE
HANDLE
CLIPS TO ATTACH HOOD TO DRUM
CONTROL VOLUME 150 X AREA TO BE CONTROLLED
DRUM

Fig. 7: *Portable hood for control of vapor from open drum liquid filling operations.*

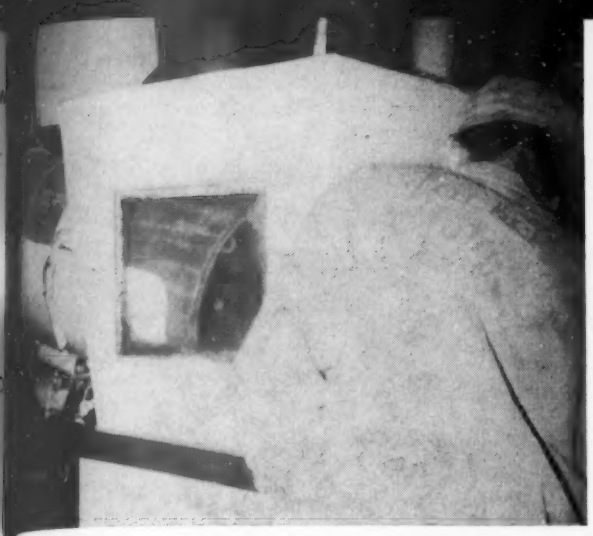

Fig. 1: *Loading beryllium pebbles into magnetic separator on production basis. Drum lid is removed after drum is tipped into hood. Pebbles flow from drum by gravity with help of a vibrator. Operator regulates flow with hoe projecting through side of hood, and by adjusting drum handle elevation with an electric winch. Velocities are 250 fpm, at air volume of 375 cfm. Beryllium concentrations are: high, 7.9; low, 1.0; median, 3.6.*

A primer on . . .

Practical Ways to Collect Beryllium Dust

PART III

by A. J. Breslin and W. B. Harris
Health and Safety Laboratory
U.S. Atomic Energy Commission

This month's article takes up drum filling ventilation, duct design and collector selection methods.

Drum Filling—Production

A drum filling station must effectively curtail the following: 1) primary dust during filling, 2) dust dislodged from the drum lip when and if the drum is covered, 3) dust settled on the exterior drum surface, 4) dust dislodged from the filling hopper and hood after the drum has been removed, and 5) excessive loss of product into the exhaust system.

The severity of dusting from these causes is dependent upon the dryness and the particle size, but it is rare for a material to be completely non-dusting. A wet material, for instance, can constitute a serious air contamination source. Considerable housekeeping problems have arisen from drums filled with a wet cake when small cake deposits were allowed to remain on the outside of the drums. After a short storage period the exterior deposits dry and later create significant general air contamination when the drums are moved. This is not a hood problem in the strict sense, but such details require attention in the design of dust controls.

The drum filling problem may be most suitably met by the use of both primary and secondary ventilation. The principle of this arrangement is to remove the bulk of the dust at its primary source, around the hopper and the top of the drum, with an exhaust collar, but with the added safeguard of an enclosing hood with separate exhaust.

The enclosing hood retains the dust which may escape from the collar during filling, provides control while the drum is being lidded and cleaned, and retains dust which may be dislodged from the hopper after the drum has been withdrawn from the hood. This arrangement, although probably one of the most effective, is not necessarily foolproof and depends for its success largely on the care with which the attendant positions the drum within the hood and closes and cleans it prior to withdrawal.

The exhaust volume rate applied to the secondary hood should be sufficient to create an inward air velocity of 150 lfm at the face. The volume rate applicable to the exhaust collar will depend on the design, 150 cfm/ft^2 of panel top being a rule of thumb value valid for many designs. Great care must be taken in design, however, to minimize the evacuation of significant quantities of valuable product.

(Please turn to following page)

About The Authors

William B. Harris has had over 23 years' experience in industrial hygiene, and at the present time is Director, Environmental Sciences Division, Health and Safety Laboratory, U. S. Atomic Energy Commission. He is a member of the faculties of New York University, Harvard University and an annual guest lecturer at University of Rochester. Mr. Harris holds a Ch.E. degree from Renssalaer Polytechnic Institute and a degree in M.S. Industrial Hygiene from Harvard University.

Alfred J. Breslin is Chief, Field Services Branch, Environmental Sciences Division, U. S. Atomic Energy Commission. He has participated in planning, coordinating and administering the investigation, evaluation and control of radiation and toxic hazards in and around facilities operated by and for the Atomic Energy Commission. He holds an M.E. degree.

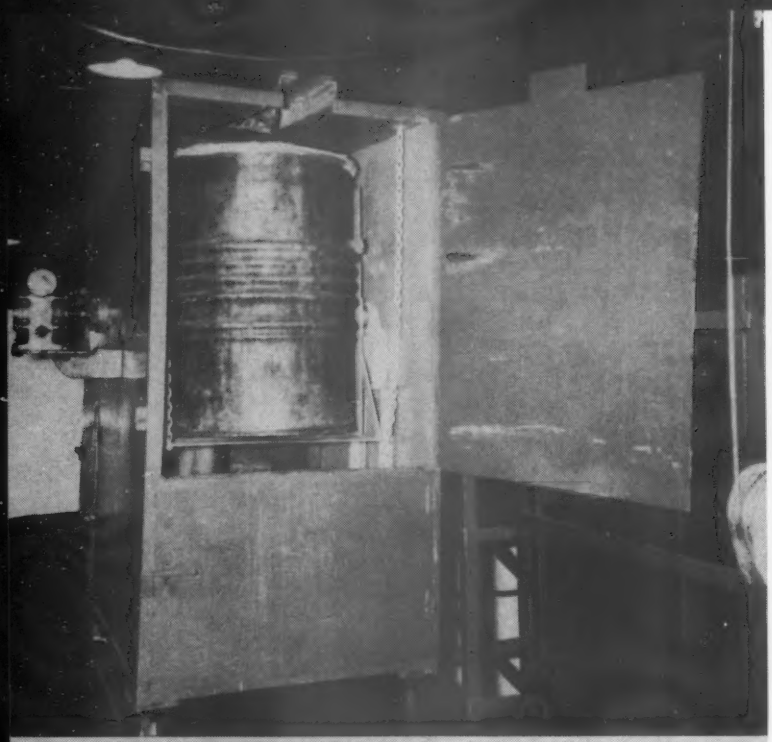

Fig. 2: *Production charging of furnace with beryllium fluoride. No data given on air volume and velocity. Castored enclosure moves on a track to a position over a reduction furnace charge opening. The drum is tipped on a hand-cranked cradle and dumps through a chute in far end of enclosure. Door is closed during dumping. Flexible exhaust connection ventilates cabinet.*

Fig. 3: *Skip hoist used to dump drums of beryll pebbles into vezin sampler. Lid is placed on or remov from drum at position directly in front of hood, in indraft air stream.*

(Continued from preceding page)

Drum Dumping

This aspect of transfer is equally difficult. Dumping arrangements which do not expose the drum exterior to dust have been most satisfactory. These generally consist of a cradle on which the drum is tipped over to discharge into a hopper with a ventilated inlet as shown in Figs. 1 and 2. Special provision may be required to control dust emitted while the lid is removed and/or the drum is being turned from the vertical to the dumping position. Dusting during this part of the dumping cycle may be serious if the material is dry or finely divided. A movable hood member mounted on the cradle or actuated by the cradle motion can be arranged to follow the drum and provide ventilation in this case. Dumping is generally more rapid than filling; hence, air displacement within the hopper must be compensated for in the calculation of the proper hopper ventilation rate. It is also important to make provisions for the dusty air remaining within the drum after dumping and for the material sticking to the sides.

Skip hoists have been used successfully for drum dumping, as shown in Fig. 3. The entire drum travel must be enclosed and ventilated. The drum exterior can become contaminated in this operation, and provision for its decontamination should be made available where the drum is withdrawn. A drum washer within the ventilated enclosure can be designed to insure adequate cleaning.

Pneumatic unloading is an alternative to dumping. A standard drum hood with an opening through which a pneumatic gulper can be inserted provides adequate control, as shown in Fig. 4. Pneumatic conveying is unfortunately limited to noncaking and relatively noncorrosive materials.

Duct Design and Application

Whereas the local exhaust hoods in a beryllium plant usually must be superior to those found in other industries, system design (i.e., layout, transport velocity, and sizing) can follow standard practice. The only exception is that leakage from exhaust ducts is not permissible. This requires more rigid specification of construction materials in terms of fabrication, corrosion resistance, and joint sealing. Specifications for exhaust system design which offer guidance in duct installation to minimize leakage and provide adequate transport velocities follow:

1) Materials

a) Sheet pipes or ducts should

Pipe Diameter	U.S. Standard Gauge of Metal For Dust Systems	For Non-corrosive Vapors, Gases, Mists or Fumes
Up to 8″ inc.	20	24
Over 8″–18″ inc.	18	22
Over 18″–30″ inc.	16	20
Over 30″	14	18

constructed of not less than the lowing gauges of metal:

b) Elbows and bends should be e from metal at least 2 gauges ier than required for piping nected thereto up to #14 gauge heavier.

c) For the collection of corro- vapors, gases, or fumes, the ts and air moving equipment uld be constructed of or coated materials of corrosive resist- properties. This coating shall er all interior surfaces includ- duct joints.

Construction

a) Longitudinal joints or seams pt of welded construction uld be double locked or lapped 1 in. and riveted with rivet centers not more than 3 in. apart.

b) Girth lap joints should be made so that the outlet end of one length fits into the inlet end of the next length in the direction of air flow.

c) All joints, seams, corners, etc., should be sealed air-tight either by soldering, welding, or other permanent sealing method.

d) Spot welding may be used in place of rivets in equal number provided steel-to-steel fusion at each weld is secured.

e) Piping should be so located so as to be accessible for inspection and maintenance and should be protected against external damage.

3) Design

a) The velocity of air in any main or branch pipe carrying dust should not be less than 3000 fpm and not more than 4000 fpm in horizontal pipes. For vertical pipes the velocity should be increased by about 20 percent.

b) Cleanout openings should be provided in all horizontal runs of pipe carrying dust laden air and should always be provided near bends, pipe junctions, and vertical runs of pipe.

c) The use of dampers, gates or orifice plates should be avoided wherever possible.

Collector Selection

In any facility where substantial quantities of beryllium materials may be carried in the exhaust system, the selection of air cleaning equipment will require careful consideration for two reasons: 1) beryllium admitted to the air outside the plant may create a neighborhood dust hazard, and 2) the beryllium content may be sufficiently valuable to warrant salvage. From the latter point of view a simple comparison of the cost of the collection installation and operation with the anticipated saving of beryllium content will indicate the optimum air cleaning facility. A complete treatment of air pollution control has been presented in AIR ENGINEERING, August-September-October, 1959.

Respirators have a definite but limited place in the general control program. Their use should be held to a minimum and carefully regulated.

The authors have taken the position that respirators should not be used as a control measure unless a job cannot be practically controlled by ventilation or some other primary method. This position is particularly justified in beryllium processing, where it has been

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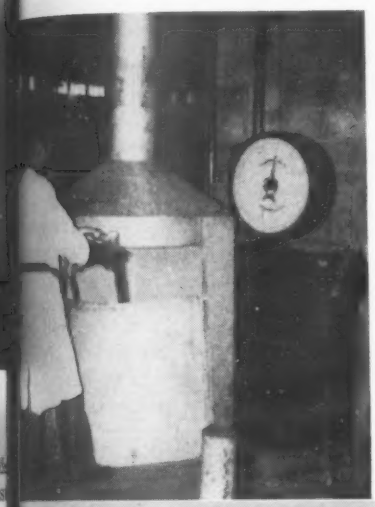
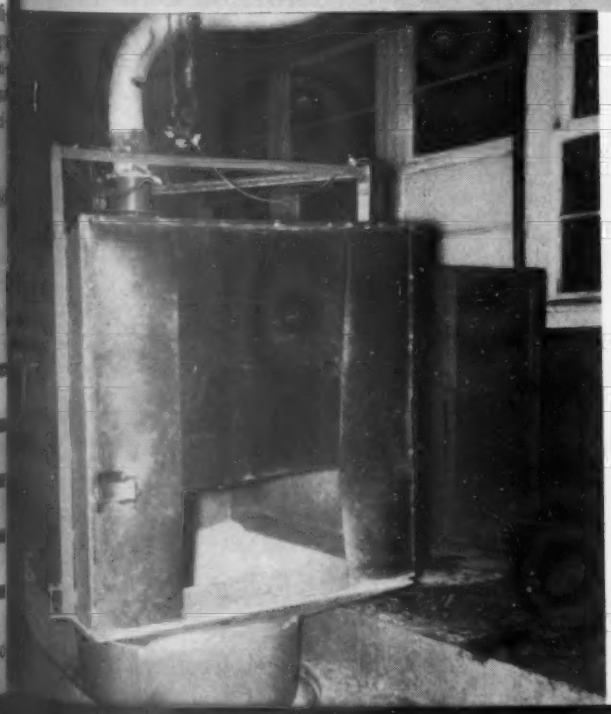


Fig. 4: (Above) Pneumatic unloader handling beryllium ide fines. Beryllia is transferred from drum to hopper r a fusion furnace. Drum hood is mounted on floor l edge of a scale platform. Drum, in hood, is on scale latform. Drum lid is not removed until drum is within ood and door is closed. Gulping tool stays in hood when d in use. Air velocities are from 250 to 350 fpm with or closed, at 1500 cfm.

Figs. 5 and 6: (Below) *Two views show hood over a chute which discharges to a ball mill below. Rubber flaps conserve air capacity by producing maximum velocity around the drum when it is in dumping position. Drums contain beryllium pebbles, beryllium fluoride and magnesium fluoride. Air velocities are 300 fpm, at 450 cfm.*



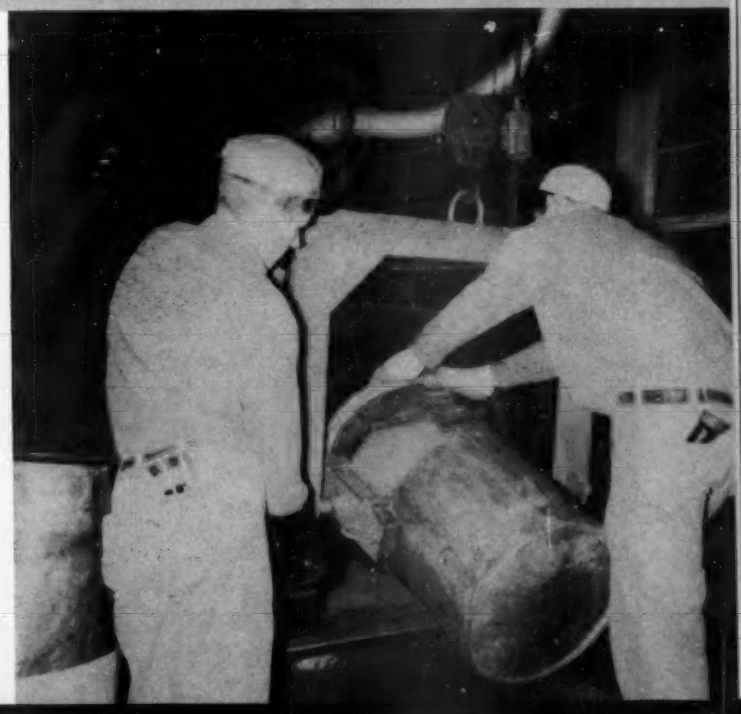
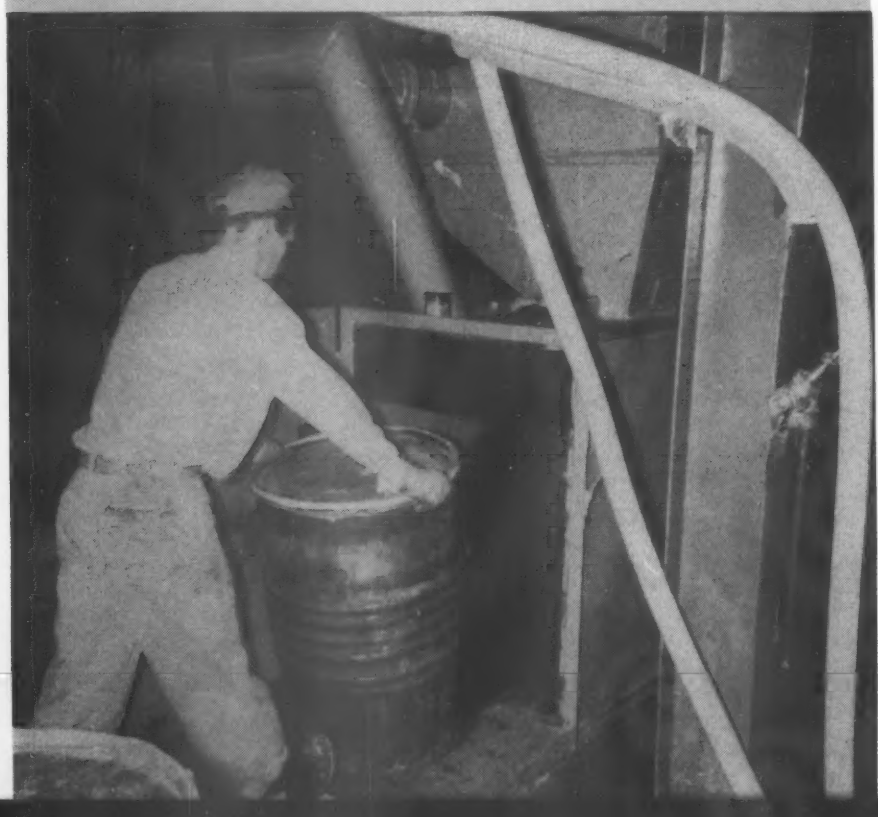


Fig. 7: *Beryllium pebbles being dumped from drum into production magnetic separator. Drum is lifted into position on cradle, lid is removed and left inside enclosure. Door is closed, further operations are conducted through access window on other side of housing. Cradle is lifted with hand-turned windlass.*

Fig. 8: *Beryllium fluoride casting furnace discharge, for production of molded beryllium fluoride pieces. Drum enclosure has doors at two ends. Empty drums are introduced at end opposite that shown. Molded pieces of fluoride drop into drum positioned below discharge chute. Level of material in drum can be viewed through a small window at one side of enclosure. Drum lids are placed and removed inside enclosure. Velocities are 100 to 275 fpm at 2000 cfm.*



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demonstrated that illness can de
velop from a single high exposur
of short duration.[4]

Many maintenance and repa
jobs commonly are impossible t
control adequately with ventilatio
such as disassembling equipmen
and changing split dust collecto
bags. These are occasional task
performed by a relatively sma
number of persons over whom
careful supervision is possibl
Respirators are permissible mean
of control in such operations. It i
advisable to perform such oper
ations in a manner which prevent
exposure of persons other tha
those directly involved by trans
ferring equipment, if movable, t
a special ventilated maintenanc
room or by restricting major repai
jobs to off-hours.

Within the cited limitations, dus
or fume respirators of the filtratio
type may be used with reasonabl
confidence for concentrations up t
about 100 $\mu g/M^3$. At higher value
the use of air-supplied respirator
is recommended.

*Next month, Part IV will tak
up housekeeping methods, clothin
recommendations, in-plant ai
monitoring and give values fro
various operations.* ▲▲

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1. Harris, W. B. and Breslin, A. J., "Techniques for Control of Beryllium Dust," Air Engineering, August, September, October, 1959.
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What You Should Know About RESPIRATORS

PART V

If plant ventilation system fails and workers face lethal concentrations of toxic gases . . . if dusts are hard to control, you may need respirators. Here's the fifth of a series on industrial dusts, gases and vapors . . . and the respirators to protect against them.

by H. H. Fawcett
Research Laboratory
General Electric Co.

Fig. 1: *Photo above shows how not to wear a respirator. Article gives other precautions with regard to proper method of respirator use and application.*

In this fifth of a five part series on respirators, smaller self-contained breathing apparatus is discussed. Maintenance, training and medical precautions generally, in use of all types of respirators, are outlined.

Smaller Self-Contained Inhalation Devices

As noted previously, U. S. Bureau of Mines approval for self-contained breathing apparatus currently makes no provision for apparatus rated for less than 30 minutes. In emergencies where a smaller, less cumbersome device with a shorter life would give adequate protection, the only available devices until recently were regular demand masks with smaller cylinders for 20, 15, and 7½ minutes service, using the same facepiece, reducers and regulators as on the larger approved devices.

Recognizing that many (perhaps most) breathing emergencies can be brought under control in 10 minutes, and that the first 130cc of expired air contains relatively little CO_2, there is now available a light-weight device in which oxygen from small cylinders, supplemented by the first 100cc of the previous exhaled breath, is used for breathing at a rate of 7 liters per minute. The device is still too new for extensive field experience, but represents a novel and new approach to the weight, bulk and cost of presently approved equipment. For a quick inspection of an area of limited size, these small units have value, but should not be depended upon to provide breathing protection if vigorous work or long periods of time are required.

Maintenance, Training and Medical Precautions

In discussing respiratory protection, we have shown the importance of breathing "good" air, briefly reviewed major air contaminants, and discussed briefly apparatus available. We have stressed the limitations of each type, rather than the advantages, since we believe that limitations were not as widely appreciated as advantages. The ideal breathing apparatus has yet to be developed. We have tried to create the impression that a very thorough knowledge of the particular apparatus used is essential for its safe use under various conditions.

Maintenance of the apparatus in first-class condition so it is immediately ready for use at any time is likewise very important. Metal parts of apparatus will wear, tarnish or corrode; rubber parts will slowly "age." Facepieces will take a "set" and must be discarded. Cylinders, regulators and valves on demand-type apparatus must be checked frequently for leaks; canisters on industrial or universal service masks or chemical cartridge respirators must be replaced.

Washing the facepiece with an antiseptic solution or soap, rinsing in clear water, and drying will assure that sanitation and cleanli-

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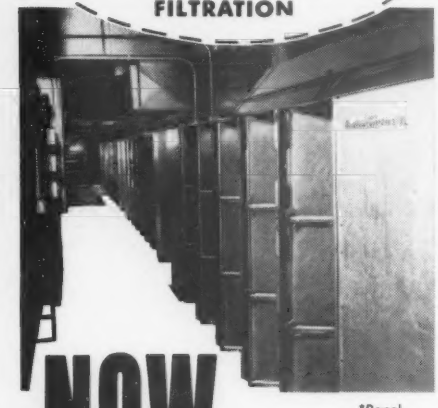

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ness is not neglected. This also prolongs the useful life of the facepieces.

Proper storage conditions and frequent checking for deterioration are as important with respiratory protective equipment as with fire extinguishers, parachutes and lifelines.

Training is the third, and perhaps most important leg of the triangle of respiratory safety. The writer believes that the most serious deficiency exists in this phase of the respiratory program. Putting on a device for a few minutes once a year is not adequate training. The U. S. Bureau of Mines Health and Safety Activities, through its district and sub-district offices, conducts training courses in first-aid, and also in the use of various emergency breathing apparatus. The courses can be modified to meet special needs on request. Addresses of offices which offer these courses may be obtained by contacting the Health and Safety Division of the Bureau of Mines, 4800 Forbes St., Pittsburgh.

During training, breathing apparatus should be worn for relatively long periods, in dark and confined spaces, climbing hills or stairs, duplicating all manual labor expected, and in smoke-filled atmospheres while performing work by hand-carried lights. Smoke generators are available which will quickly fill a room, a basement, a tunnel or a small building with a smoke that is realistic, but which is relatively harmless and can be ventilated out without any damage.

The "buddy" system and team drill should be practiced, as in a real emergency. Use of life lines should be a part of this training, and should be a standard part of any underground, tank or smoky operation.

Signals as used by mine rescue

Fig. 2: *Small, self-contained mask widely used in steel and chemical plants for protection against toxic dusts, fumes, mists, fogs and smokes. Photo courtesy Mine Safety Appliances Co.*

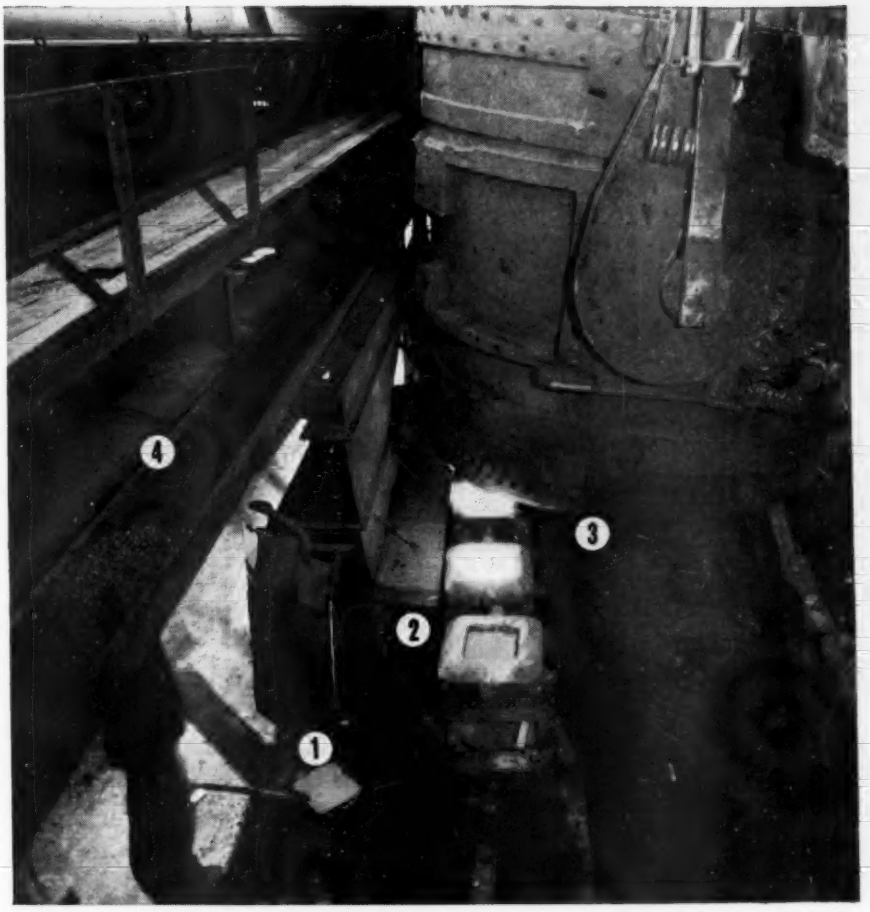
teams based on OATH (O=OK=1 pull; A=advance=2 pulls; T=take-up=3 pulls; H=help=4 pulls) should be employed and stand-by men, ready to enter the area for rescue, should always be on hand. Hand-carried short-wave two-way radios also prove useful for communication between base and field party. When used in atmospheres which may contain flammable vapors or gases, any electrical devices should have a "permissible" rating by the Bureau of Mines for the gases or vapors involved.

Physical Check-up

Need for proper physical examinations for persons wearing emergency equipment is too obvious to require mention, but apparently has not always been appreciated in the past. A regular program of physical check-ups with particular attention to the respiratory and circulatory system as well as general physical condition probably would have prevented some cases where inhalation of a smoke combined with physical exertion with or without respiratory protection, has produced serious illness. Pulse rates before, during and after exercise, general physical condition, moderate weight, good eyesight and proper teeth alignment (where mouthpiece breathing is involved) are considered vital to pre-training by the Bureau of Mines instructors.

A practice of not permitting persons to return unprotected to smoke or fumes after they have been overcome and revived, would help prevent more serious inhalation effects. Such restraining action may require physical force to implement it in practice, since a patient who is partially recovered from fume or smoke inhalation may display highly irregular behavior. One recommendation is that persons sufficiently exposed to smoke and carbon monoxide to require treatment should not return to active duty in less than 4 to 6 hours, while those who have been rendered semiconscious or unconscious should rest 24 to 48 hours.

In conclusion, it should be stressed that properly maintained breathing apparatus, used with full appreciation of its limitations, by healthy persons, properly and adequately trained, will eliminate most "fume" disabilities in the future, but that the ideal breathing apparatus for all applications has yet to be developed, and may not be developed until there is sufficient demand for it. ▲▲



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Questions And Answers On . . .

Super-Clean Room Desig

Here are answers to questions asked by readers on super-clean "white" room dust monitoring, personnel dust-off, and clothing.

Wants Way To Blow Dust Off Clothing

"Would appreciate info on quick way to clean clothing, hair, etc.—without using air hose. Brooms or brushes too slow and ineffective."

ANSWER:

There are two instances encountered in industry where workers' clothing and person are cleaned free of dust, dirt, debris, etc. The first instance is where the worker is entering a dust free or bacteria free room. It is essential in such cases not to carry any contamination into the room.

The workers should be provided with fresh laundered, clean garments daily. Dust from exposure to air outside the dust free or bacteria free room is removed by means of "air showers" located just before entering the room. An air shower is a blast of air directed on a workers clothing and person for blowing off contamination on clothing. Usually an over head blast or jet is considered ample, although side jets can also be installed.

The second instance is where a worker has been exposed to a dusty process which has dusted his clothing and person and it is necessary to clean up to prevent further exposure to the dust and to reduce contamination to cleaner areas, office, home, car, etc.

In other words the worker would like to "clean-up" after his clothes and person become dirty. If the dust is highly toxic i.e., lead, cadmium, etc. he should bathe and change clothes before going home or the exposure will be increased to himself and passed on to his family.

Blowing the dust off with compressed air should not be done for two reasons.

One, the compressed air hoses used are conducive to "horse play" from worker which has resulted in both serious and fatal injuries.

Two, the dust is blown into the air and breathing zone of the worker, resulting in high concentration exposures.

Vacuum cleaning appears to be the preferred way of cleaning rather than blowing (although it is slightly slower).

Commercial vacuum cleaners with both greater air flow (cubic foot per a minute) and static pressure ratings than domestic units are available. These units are available with a great variety of nozzles and vacuum brushes of all sizes and shapes. The commercial units also has a greater dust storage capacity than the domestic units.

To speed up cleaning where a number of workers are involved, a pipe system with several cleaning hoses and nozzles could be installed. If the hair of the worker becomes dusty, it would be preferable to have the worker take a shower to remove the dust. The use of a head covering, cap, hat, etc. should be used where possible.

How Can Airborne Dust Be Monitored?

Question:*

Is there a dust monitor available for use in ultra-clean rooms that could monitor and record, on a practical basis, hourly readings? Range of interest is about .4 to four microns.

I.M.K.
Albuquerque, N. M.

ANSWER:

There isn't any simple answer to Mr. K's question. He has to decide first of all whether he wants continuous monitoring or whether he just wants spot sampling. Spot sampling would seem to lend itself best through the use of a membrane type sampling filter such as the Millipore Filter. A sample can be taken for a given period of time, and the filter media treated with oil of immersion so that the media becomes transparent, and only the dust particles are left to observe. These can be counted under microscope. By knowing the to number of particles collected, a knowing the air volume sampl it is simple to calculate back to t concentration of dust in the roo One of the advantages of t membrane type sampling filter that it is also possible to measu particle size distribution.

Although some people use s tling techniques to monitor pro sion assembly areas, it is our p sonal opinion that these meth are too crude and subject to t many subjective errors to enco age their use. Moreover, a setti technique only indicates the pr ence of extremely large partic since then only they will settle a reasonable period of time.

Although the "konimeter" h long since been abandoned as dust counting tool by various dustrial hygiene personnel, understand that there is appare an improved model available wh gives more accurate readings. is being used by one manufactu of photographic materials and th seem satisfied with its use.

The more sophisticated, and co sequently more complex and exp sive, units are the various d counting machines which dep on a light scattering effect. O commercial units are now be offered on the market which characterized by greater compa ness than some of the origi designs. For instance, Royco I struments Incorporated in Mo tain View, California have particle counter which is priced \$6,975.00.

Sometimes monitoring can done by units which do not nec sarily count individual partic but are able to detect change concentration. These units usually less expensive since t do not require any discrimina circuitry, such as the small part detector made by Gardner Ass ates in Scotia, New York. T unit is being manufactured un G. E. license. It operates on cloud chamber principle, u small particles as nuclei on w droplets will form when a su saturated condition exists in

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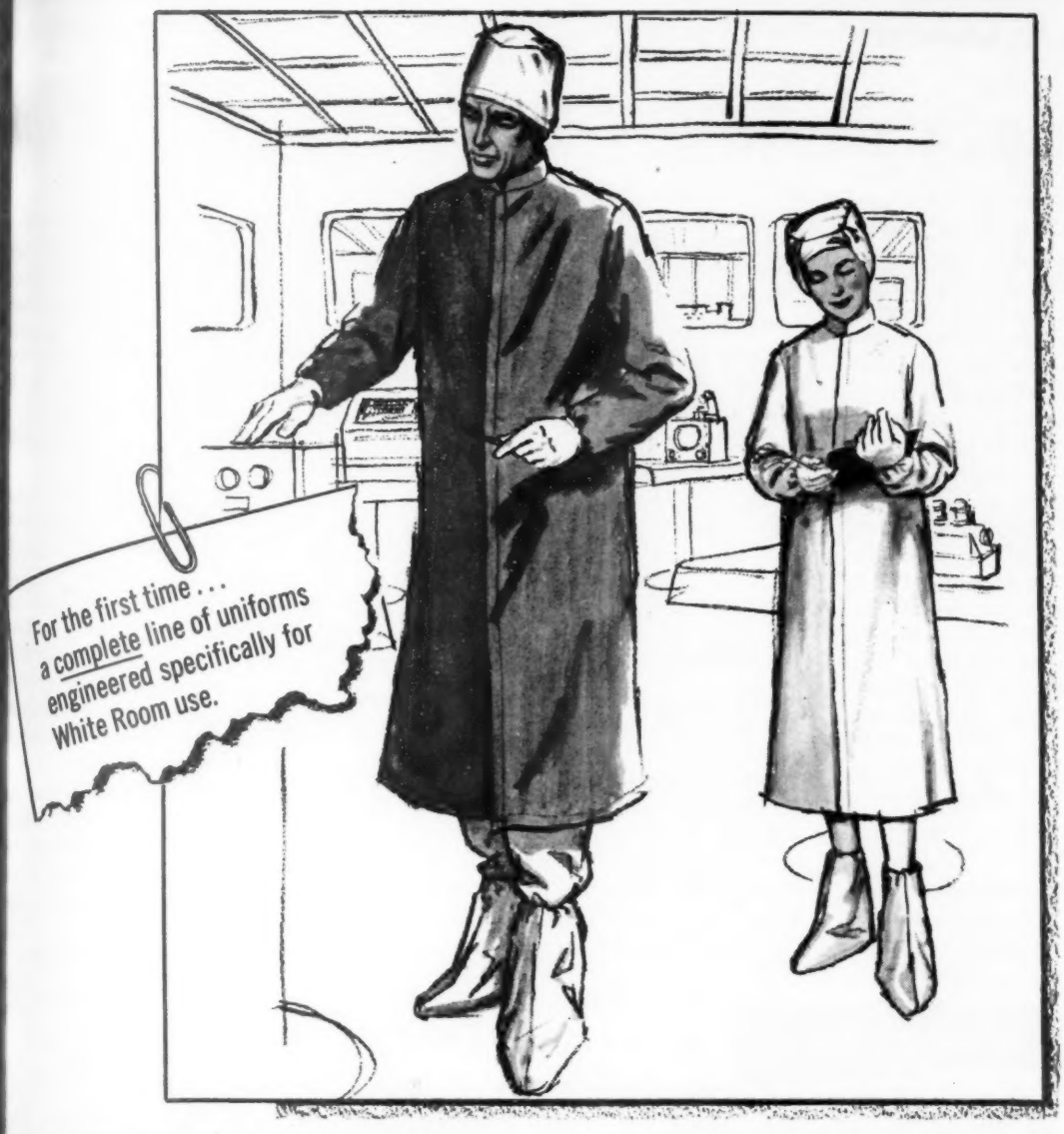

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- ✓ *No pockets, pleats nor any other dust collectors*
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Questions & Answers

(Continued from page 48)

sampling chamber. The minimum number of nuclei which they can count is 200 per cubic centimeter. This does not have the necessary low level accuracy if all the particles in the 0.3 micron range and larger were being counted. However, since particles even smaller than this can act as condensation nuclei, it is possible that a total level reading can be secured which has some significance in terms of a specific job. Here again, the direct count would not be as important as increases or decreases in count. One or two elements of the machine seem to be subjected to operator technique, but once a standard procedure is developed, this machine might prove to be very effective. The price of the unit is $400.00, and it is portable.

Two of our consulting editors have answered this question from Mr. K. Please see page 21 in the August issue for the other answer.

Question:

We have an air conditioning unit which includes a refrigeration unit for control of both temperature and humidity. The set up is such that the water sprays directly on the refrigerated coils, but because of the high mineral content in our water supply, we are experiencing a corrosion problem on these coils plus a heavy deposit on the coils. Would it be advisable to modify the spray system so as to have the water spray onto removable glass filters and keep the deposits off the coils?

This condition has caused a problem of dirt in the area serviced by this unit, especially if and when the spray water is turned off and the coils allowed to dry.

Any information you can furnish toward the solution of this problem will be greatly appreciated.

W.F.E.
Richland, Wash.

ANSWER:

The practice of spraying water for humidification on refrigerated coils is somewhat unique and not generally encountered in most air conditioning practices. There is no reason, however, why the water spray could not be located before the refrigerator coil and be followed by water eliminator plates* for removing droplets. Inasmuch as the air temperature would drop on going through the coils there may be some condensate water formed on the coils. This however would not be the high mineral content water which is so corrosive but rather distilled water.

Glass filters as suggested in the letter could be used but they would tend to plug sooner than the water eliminator plates and require more maintenance. The coils should be thoroughly cleaned before the eliminator plates, or filters are installed, to prevent the blowing off of corroded material into the area serviced.

**Fan Engineering, Buffalo Forge Co., Buffalo, N. Y., P. 587.*

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EXECUTIVE REPORT #3

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Bulletin No. 562-D illustrates how industry relies on Dustube Collectors for efficient dust and fume control. Write to Wheelabrator Corp., 498 S. Byrkit St., Mishawaka, Ind. In Canada, P. O. Box 490, Scarborough, Ontario.

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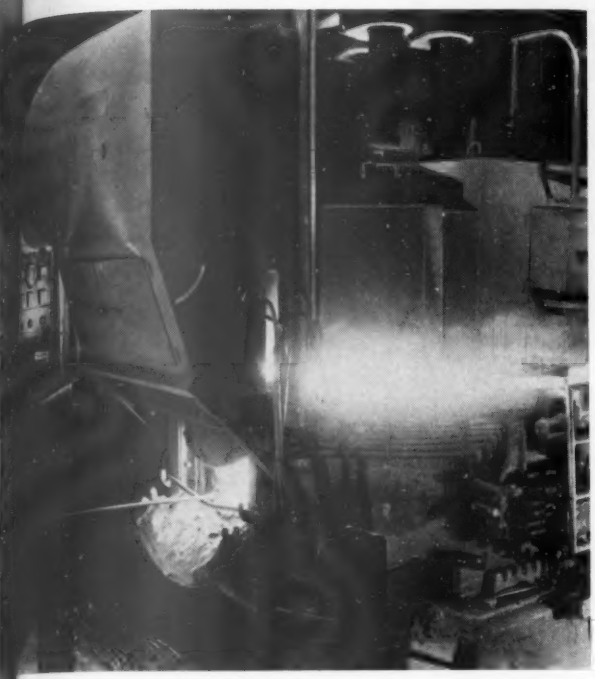


How to Control Emissions From Electric Steel Melting Furnaces

PART I

Fig. 1: *Oxygen lancing of the 96 in. furnace at Electric Steel Foundry Co., Portland, Ore. High efficiency of roof-type hooding and ventilating system traps smoke, keeps it from entering foundry. Photo courtesy Wheelabrator Corporation.*

by V. C. Doerschuk
Secretary,
Joint Smoke Control Research Committee
Allegheny County, Pa.

This study of 26 companies using 59 direct arc steel melting furnaces discusses existing methods of emission control, including fans, hoods, hood design, duct systems, source and nature of pollutant.

THIS COMPREHENSIVE REPORT on how to control emissions from electric furnaces is based on a study of 26 companies operating 59 furnaces in the United States.

This article will discuss the emission control problem, describe various methods of collecting dust from the furnace, and of removing dusts and fumes from the collected emissions. Part I will take up use of fans, natural ventilation, collecting hoods, roof-tap systems and duct systems.

Emission Problems

Without a collector* when furnace doors are closed, the furnace operates under internal pressure generated by the charged materials being heated, melted, and chemically reacted. The melt may be up to 3000F. Fume and fine particulates are produced which under pressure leave the furnace through electrode ports, spouts, door and other leaks, constituting furnace emissions.

When the furnace doors are open for inspecting, charging, fluxing, and at other necessary times, the emissions also escape through these openings.

When injecting oxygen into the melt through a pipe lance for oxidizing certain components, the emissions are greatly increased in volume. Some operators partly lift the furnace roof to allow the increased volume to escape without causing too much internal pressure.

Even while the furnace is normally under pressure, some air enters at door leaks and spouts, being drawn in by the rising hot gases escaping from the electrode ports and leaks around the top of the furnace. Any entering air reacts with the charge, the electrodes, the slag, and may increase the power required.

The escaping emissions are carried by the building ventilating air to the roof where they are dissipated into the atmosphere. Some emissions, depending upon the design of the ventilating system and air currents within the building, reach other parts of the building before they are carried to the roof or out of the building through other openings.

Use Of Fans

Fans are used in the building roof in some installations to better direct and increase the flow of ventilating air. This arrangement can be improved by building vertical walls in the roof trusses from as near the furnace as possible up to the fan area, thus concentrating the upflow nearer the furnace. In a multi-furnace installation of 280 tons furnace capacity, fans in the roof handle 1,320,000 cfm.

One operator had planned to install a canopy or hood in the roof of the building to collect the upward moving air, from whence it

(Please turn to following page)

**Herein "Collector" means an installation on the furnace to collect its emissions. "Cleaner" means the subsequent installation which removes the dust and fume from the collected emissions.*

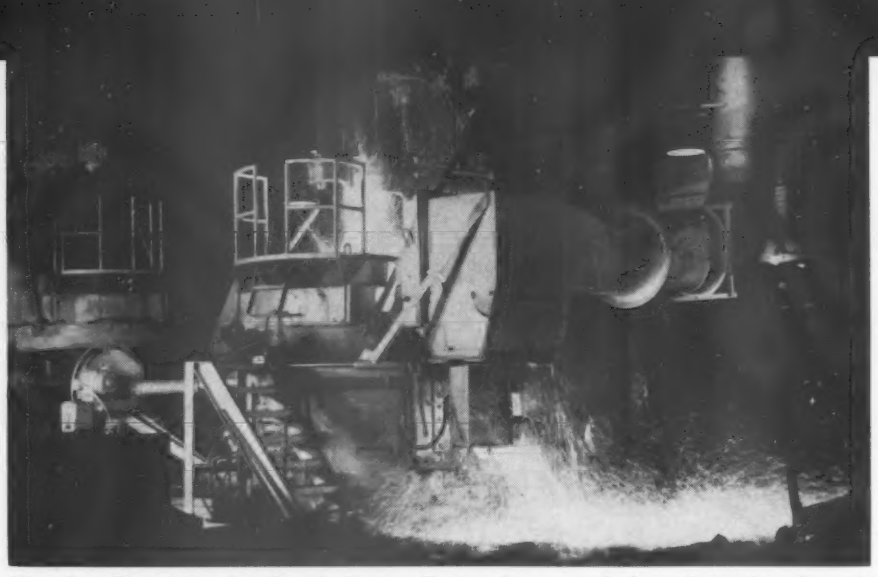


Fig. 2: *Roof-type hood and dust collector keeps emissions from foundry air at Ohio Steel Foundry Co., Springfield, Ohio. Dust at rear of furnace vents smoke and dust to collector outside building. Photo courtesy Wheelabrator Corporation.*

would be taken to an electrostatic precipitator (hereafter called Cottrell) for cleaning. This would involve handling all or more than the normal ventilating air. This plan was abandoned as being too expensive.

Good natural ventilation can be secured by having only two places in the furnace building for openings to the outside. The first consists of escape openings in the roof. These should be regulatable to conform to the heat KW liberated by the furnaces, the temperature rise of the incoming air, and velocity of escaping gases. The design should be such that there will be no down drafts from the roof openings under various wind conditions. The second consists of air inlet openings at the base of the building. These should be as near the furnace as possible, should be near the floor, and should be 1½ to 2 times the area of the roof openings. In some instances the incoming air can be carried nearer the furnaces by ducts rather than by using only wall openings. If the furnaces sit over a basement into which air is admitted for upward movement through gratings around the furnace, the same area relations apply. Such a system places incoming air near the source of furnace emissions and gives the workmen better protection from emissions as well as cooler air. No other building openings should be allowed, such as other open windows and doors or openings beneath the eaves, which would diminish the desired air flow from near the furnaces to the roof escape.

Emission collecting hoods are of six general types. One type is a hood on or somewhat above the furnace roof, usually with extension canopies over doors and spouts. The usual type of hood is about the same diameter as the furnace roof, has a vertical ring periphery, a flat or arched deck, may be tight fitting to the roof ring or its ring may sit slightly above the roof ring allowing cooling air entrance. There are openings in the hood deck for the electrodes. Here hot gas from the electrode ports may warp or burn the deck, so in some installations the area around the electrodes has the steel replaced by castable refractory reinforced slabs, about 2½ in. thick.

In one installation using 20 in. electrodes the holes through the slabs are 30 in. in diameter, allowing entrance of cooling air. There may be regulatable air ports into the hood periphery to cool the emissions, hood and furnace roof. At one side of the hood is a steel take-off box connecting to the hood periphery. To this box is connected the fan duct.

Another type of emission collector consists of two funnel shaped canopies, one on each side of the furnace top opposite the roof and the electrodes, and a hood of about the furnace diameter suspended above the furnace top. This syste requires more cfm than with hood fitted near the emission outlets.

A third type is a hood simila to the first collector noted abov but somewhat larger than the fu nace roof, with its ring hangin some inches below the roof rin thus forming around the furnac top an annulus into which smok is collected and cooling air en trained. A variation of this migh be a closing of the annulus excep where emissions escape, thus in creasing the draft at the ope portions.

A fourth type is a roof hoo (Figs. 1 and 2) appreciably smalle than the furnace roof, about 1 the diameter, containing electrod openings. This collects emission from the electrode ports. A circu lar duct of rectangular section i around the top of the furnace an extends over part of the furnac roof height. This duct is open a the joint between the furnace an its roof, into which opening emi sions are caught. From this duc canopies extend over doors an spouts. When lancing, if the roo is slightly lifted, the emission escaping from between roof an furnace are caught in this duct. A duct from the hood and from th circular duct lead to a take-off box then to the fan. When the roo is lifted and swung, a damper shut off the hood connection, then th exhaust continues on the circula duct.

A fifth system being develope has a small hood around each electrode, each of which is con nected to a duct. No doubt, door and spout hoods will be added

Fig. 3: *Telescoping and swivel connection on exhaust hood for continuous exhaust of emissions from electric steel melting furnace. Furnace is shown in tilted position. Photo courtesy Pangborn Corporation.*

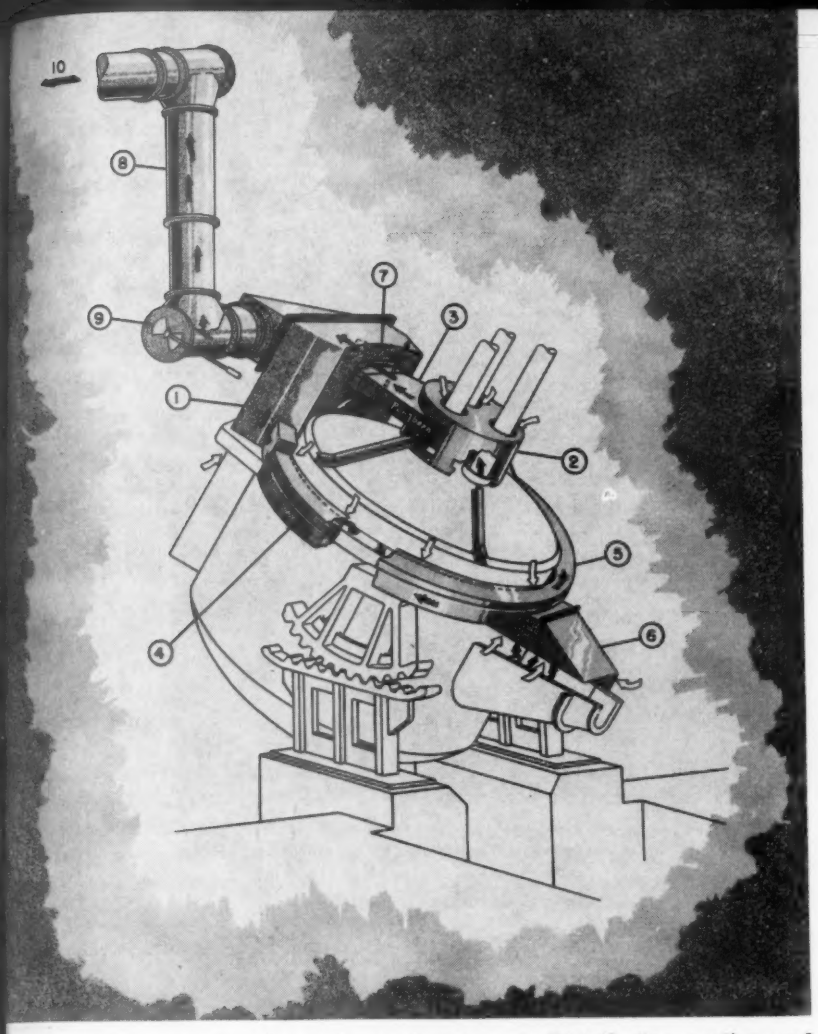


Fig. 4: *Electric furnace exhaust hood showing:* 1. *Distribution section and ing door hood;* 2. *Electrode hood and support arms (fastens to roof frame and oves with roof);* 3. *Connecting duct;* 4. *Manifold ring;* 5. *Manifold ring baffle;* . *Pouring spout hood;* 7. *Adjustable spring loaded damper;* 8. *Telescoping and ivel connection to exhaust system for continuous ventilation during furnace* ; 9. *Tempering damper;* 10. *Duct outlet to dust collector. Photo courtesy ngborn Corporation.*

In another case, using a small rnace, a canopy made partly of bestos cloth and connected to a is suspended over the furnace, l is supported on a swing-out am.

scellaneous Hood Data

To prevent circulating induced ctrical currents in the hood ith heat it, non-magnetic strips inserted into parts of the steel.

With some hoods the electrode vel is lessened. In one instance electrode masts have been ightened to compensate for this.

The various emission collecting reams need to be so designed at the velocity at all points keeps heavier particles suspended, herwise these will deposit on the f and hood, insulating and erheating them.

Hoods should be built so as not to warp. One operator reports hoods are removed for straightening and repair every 6 months.

One operator says hoods are large and bulky, making them impractical over 15 ft. diameter, and that they restrict inspection and maintenance of upper parts of the furnace. They are ineffective during top charging and when the roof is lifted during lancing.

One user of a roof hood finds the cfm is 10 percent to 15 percent of that required by natural ventilation means.

The Roof-Tap System

The roof-tap system or hole-in-roof, consists of a hole in the furnace roof between two electrodes at one side of the roof. From this is led a vertical duct with a right-angle elbow through which the emissions are exhausted. This duct is water jacketed; however, one operator uses a heat resisting cast alloy for this purpose. The cast elbow is used on an 8 ft. furnace because the owner wanted to reduce the elbow's weight and did not want to use water. During lancing the elbow reaches a red heat for about one minute. On larger furnaces the cast elbow may become too hot.

This system is used by six companies. The furnaces are arranged below in order of diameter.

Furnaces	Diameter, Ft.	Roof hole dia., in.
2	8	12.5
1	9	20
2	10	20
1	17	32
4	19	36
2	20	32
2	20	34
2	24½	36

Collector Data

With either type of collector the furnace interior is under about .02 to 0.10 water inches vacuum, slightly more with roof-tap than hood.

With either system the negative pressure in the furnace is continuously measured for control purposes, and by most operators used to regulate the cfm exhausted from the furnace. The latter is done by controlling a damper in the duct to the fan, or by controlling the amount of cooling air admitted to the duct. In this way cfm can be regulated during various stages in a melt cycle as the emissions vary. A small steel tube is inserted through the furnace wall somewhat below the roof joint and connects to the gauge.

With hoods, air is drawn into the furnace or hood through door and other leaks, through the spout and the canopies over the doors and spout, and the emissions pass into the hood from the canopies and from the clearance in the electrode ports.

With a roof-tap, air enters all openings including the electrode port clearances, and the emissions are removed through the roof hole.

Duct Systems

From hood or roof-tap is led a short duct which is fastened to and tilts with the roof. This duct ends in a flange facing another flange on the duct to the fan. These flanges are not bolted but clear each other by ¼ in to ½ in., thus

(Please turn to page 57)

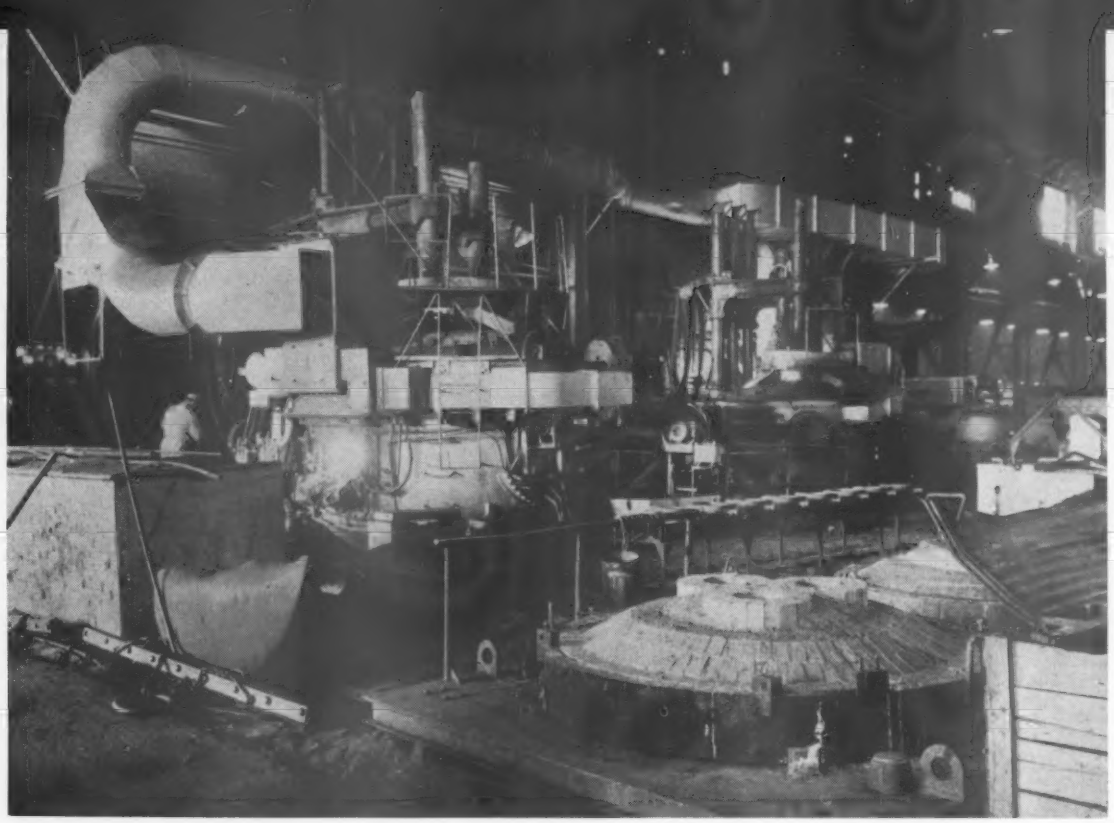
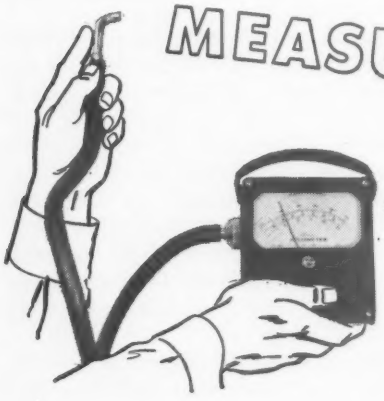


Fig. 5: *Exhaust hoods on 10 ft. dia. furnace in foreground (operating), 9 ft. dia. furnace in center and 6 ft. dia. furnace in background (not operating). Photo courtesy Pangborn Corporation.*



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(Continued from page 55)

lowing the first duct to tilt while e second is stationary. When the rnace is tilted there is no exhaust the furnace. Air enters this slip nt. One operator uses a slip nt by making one flange a large ube, with the duct adjoining it ade like a funnel with an oval ening. This allows exhaust on e furnace when tilted to about °.

One construction (Figs. 3 and 4) owing continuous exhaust is the e of two rotating right angle ows in the duct system, between hich is a telescopic section which ongates when the furnace tilts. ese ducts may be round or ctangular.

Another construction is a canvas eoprene covered) hose supported a wire spiral, the hose connect- g two adjacent sections of the ct systems. The hose may be 10 12 ft. long. This allows the haust to be continuous whether not the furnace is tilted. Enough ir has been previously admitted keep its temperature below 250°.

Another construction providing haust on the furnace at all times is made by carrying the short duct from the hood or the roof-tap, to a position concentric with the axis of the furnace tilt. Here a rotating joint connects to the fan duct. If the axis of furnace tilt moves slightly horizontally a slip joint could be made which uses the large plate and the funnel described above.

After the slip joint, the duct extends to the cleaning equipment and fan. Before entering the cleaner, unless the gas has been sufficiently cooled, dampers are provided in the ducts or the cleaner inlet to admit air. Some of these are automatically regulated by the cleaner inlet temperature.

In some instances, part or all of the cooling is performed by direct and/or indirect water or by water washers.

Specific examples are as follows:

(a) Hood box, duct, slip joint, duct to fan, duct to cleaner, air inlet valves, bag house, stack.

(b) Roof-tap, water jacketed elbow, slip joint, duct with regulated air inlet valve, fan, bag house, stack.

(c) Roof-tap, water jacketed elbow, slip joint, water sprayed spark box cooling to 500°, duct, water spray wash tower, wet disintegrator, stack.

(d) Roof-tap, water jacketed elbow, slip joint, water sprayed flame trap, duct with air inlet dampers, water spray tower, water drop out tower, fan, Cottrell with bypass, stack.

(e) Roof-tap, cast elbow, slip joint, duct to water washer, fan, bag house, stack.

Next month, Part II will take up the nature of dust, fume and smoke in furnace emissions, dust loading calculations, dust disposal, hood and duct sizing data, use of baghouses, electrostatic precipitators, operating and capital costs, installation techniques and current English practices. ▲▲

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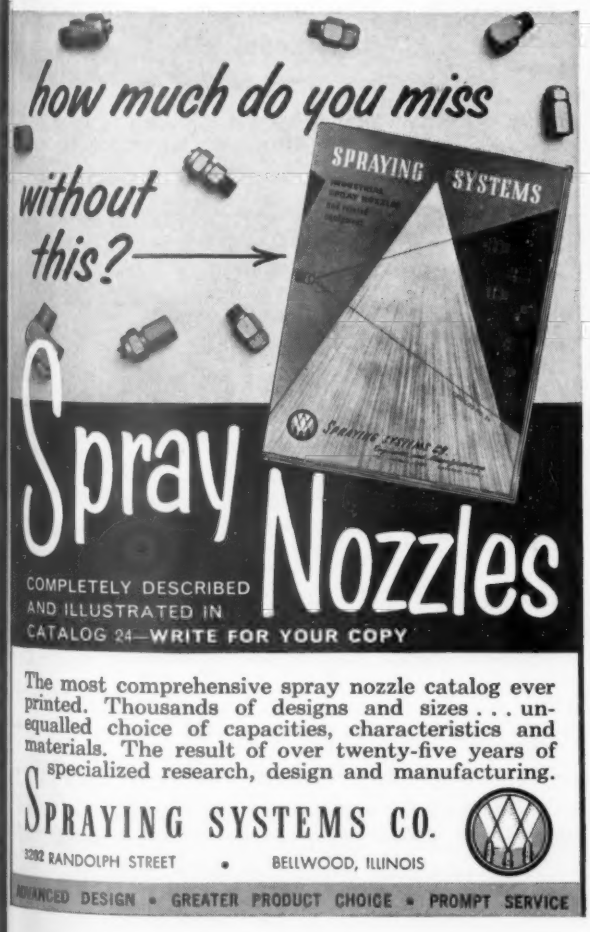
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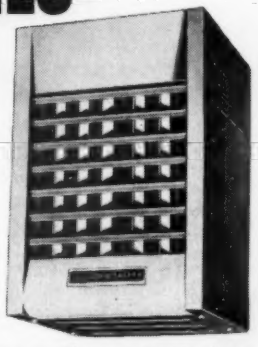

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Letters

(Continued from page 4)

thod employing the principle of lution.

In the dilution method a test s is introduced and metered into e system at a point where in- ced air enters; at a point fur- er downstream which allows for ixing (usually in the discharge ct) the air stream is sampled r the concentration of test gas. e volume rate of flow (cfm) can e determined from the extent of lution as indicated in the follow- g equation:

$$\text{CFM} = \frac{\text{Rate flow of test gas} \times 100}{\%\ \text{test gas in discharge stacks}}$$

The cross sectional area of the tack is measured and divided into he cfm to give average velocity fpm). The test gas can be ac- urately metered into the air tream with a wet gas meter or a low meter.

To get accurate results, the test gas must be carefully selected, sufficient time lapse for equilibrium must be allowed and thorough mixing must take place.

Uniform Mixing

Mixing can be attained by introducing the test gas at different points of air entrance. Proof of uniform mixing is demonstrated when the concentration of test gas is the same at several points of discharge.

The test gas selected, must not be present as a contaminate in the air stream, it must not be affected by the wet scrubber, and it must be a material that can be easily and accurately sampled. It appears from the condition of this problem that carbon monoxide gas would be a good choice for a test gas. It can be inexpensively and easily sampled by National Bureau of Standards colorimeter tubes. The range of the tubes is from .001% to .100% carbon monoxide.

George M. Hama
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*Not advertising in this issue.

PROFESSIONAL SERVICES

LAUREN B. HITCHCOCK ASSOCIATES
Chemical Engineers
Industrial Air Pollution Abatement
L. B. Hitchcock.....Edwin Cox
John H. Schaefer, Technical Advisor
60 East 42nd St., New York 17, N. Y.

CLASSIFIED ADVERTISING

RATES—Classified advertising is run in 6-point type (this size) under suitable headings. Minimum rate $5.00 for forty words or less. Extra words .15 each. Box addresses, with usual services, count as five words. Payment required with order. No agency commission, no checking copies. Closing date first of month preceding month of issue. No proofs will be submitted prior to running, but proof will be forwarded for record. No display advertising under classified headings. AIR ENGINEERING, 450 W. Fort Street, Detroit 26, Mich.

City, State, or Federal Air Pollution Control?

Air pollution should be met at local levels, with assistance from state and federal government, according to Harold Kennedy, attorney for the Los Angeles Air Pollution Control District.

On the other hand, there have been indications that local government cannot meet or combat local air pollution control problems. In New York City, it is recognized that a substantial contribution to polluted air comes from industrial sources in adjacent New Jersey.

And in Detroit, according to a recent report by Morton Sterling, chief, air pollution control, there isn't much Detroit can do about plants located outside the city. He said that about 40 percent of Detroit's air pollutants comes from sources outside Detroit. Sterling was encouraged by recent efforts of adjoining cities, such as Ecorse, to police firms within their jurisdiction, such as Great Lakes Steel Co. and Dupont's Ecorse chemical plant.